DOCUMENT RESUME

ED 250 478   CE 039 936

AUTHOR Daniels, M. Harry; And Others
TITLE The Development of a Model, Strategies and Procedures for Introducing Change Skills Instruction into Vocational Programs.
INSTITUTION Southern Illinois Univ., Carbondale. Coll. of Education.
SPONS AGENCY Illinois State Board of Education, Springfield. Dept. of Adult, Vocational and Technical Education.
PUB DATE Jul 84
NOTE 140p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS *Change Strategies; Classroom Techniques; *Coping; Curriculum Development; *Daily Living Skills; Educational Needs; Educational Strategies; *Fused Curriculum; Guidelines; Individual Power; Models; *Problem Solving; Program Development; Program Implementation; Secondary Education; Teaching Methods; Technological Advancement; *Vocational Education
IDENTIFIERS Illinois

ABSTRACT

A project was conducted to develop a model, strategies, and procedures for introducing change skills instruction into vocational programs. During the course of the year-long project, the following were to be accomplished: development and presentation of a conceptual model that provided a rationale for introducing change skills instruction into vocational programs; identification, organization, and introduction of strategies for teaching change skills; identification of procedures for teaching change skills in vocational programs; production of a technical and final research report; and production of a report for the National Center for Research in Vocational Eduication that was to synthesize the strategies and procedures for teaching change skills in vocational programs. Deliverable products of the project include three quarterly reports, a final report entitled "Strategies and Procedures for Introducing Change Skills Instruction into Vocational Programs," a technical report entitled "Adapting to Technological Change," and an article entitled "Basic Skills for Work and Living: A Model for Self-Empowerment." The appendix contains two studies: "Tentative Framework for Incorporating Problem Solving into Vocational Curricula," by Joseph S. Karmos, et al. and "Business' Perspective of Basic Skills," by Denis A. Junge, et al. (Two-thirds of this report contains tentative frameworks for transition skills training in vocational curricula and for incorporating problem solving into vocational curricula.) (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED250478

The Development of a Model, Strategies and Procedures for Introducing Change Skills Instruction into Vocational Programs

Project Staff

Administrative:
M. Harry Daniels
Joseph S. Karmos

Developers:
M. Harry Daniels
Joseph S. Karmos
Cheryl A. Presley

Department of Educational Psychology
College of Education
Southern Illinois University
Carbondale, Illinois

Illinois
State Board of
Education

Walter W. Naumer, Jr.
Chairman

Donald G. Gill
State Superintendent
of Education

Department of
Adult, Vocational
and Technical
Education

Research and
Development
Section

July, 1984

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
D Gill
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CE039936

Final Report Abstract Format

Official Project Title: The Development of a Model, Strategies and Procedures for Introducing Change Skills Instruction into Vocational Programs

Department of Adult, Vocational and Technical Education Funding Agreement Number: R31-24D-0364-460

Project Director(s): M. Harry Daniels and Joseph S. Karmos, Associate Professors of Education, Department of Educational Psychology

Location of Funded Agency: Department of Educational Psychology, College of Education, Wham Education Building, Carbondale, Illinois 62901

Time Period Covered: July 1, 1983 - June 30, 1984

Major Accomplishments of the Project:

1. Developed and presented a conceptual model which provided a rationale for introducing change skills instruction into vocational programs.
2. Identified, organized, and introduced strategies for teaching change skills.
3. Identified procedures for teaching change skills in vocational programs.
4. Produced a technical and final research report.
5. Produced a report for the National Center for Research in Vocational Education at Ohio State which synthesized accomplishments 2 and 3.

Potential Impact on Vocational Education:

This project provided educators and other personnel with a rationale, strategies and procedures which could be implemented within the vocational education curriculum to prepare students to adapt with the new technology. The strategies and procedures build on the traditional basic skills that are taught in vocational programs, but will enable students to assume responsibility for the management and direction of their lives and careers.

Products To Be Delivered:

1. Three (3) Quarterly Progress Reports mailed to DAVTE by October 1, 1983; January 1, 1984; and April 1, 1984.
2. Ten (10) copies of the final report, Strategies and Procedures for Introducing Change Skills Instruction into Vocational Programs, mailed to DAVTE by June30, 1984.
3. Ten (10) copies of the technical report, Adapting to Technological Change, mailed to DAVTE by June 30, 1984.
4. Ten (10) copies of the article, "Basic Skills for the Work and Living: A Model for Self-Empowerment", submitted to Threshold magazine by request.

Expenditure of Funds:

Total expenditures for last years grant as of Sept. 1, 1984 were: $51,028. The original budget was $60,000. The discrepancy was due to the fact that projected AND expected travel did not occur because some people were out of the country, on vacation, or quit.

Paid Participants in the Activity:

Dr. Harry Daniels, Associate Professor of Education at SIU-C worked in the public schools for seven years, both as a junior high school teacher and as a high school counselor. In the later position he was primarily responsible for developing and implementing a systematic career guidance program for students in grades 10 - 12.

During the last four years he has taught in the Department of Guidance and Educational Psychology and the Department of Vocational Education Studies. His primary teaching responsibilities are in the area of career planning, career planning practicum, and occupational education. He also served as the coordinator of the Career Counseling Center at SIU-C during the 1979-1980 academic year, and continues to serve as a member of the training staff of that facility.

Dr. Daniels was co-director of a DAVTE grant to revise the Illinois Career Guidance Handbook. In addition, he has published Facilitating Students Career Development, and numerous articles dealing with career decision making, career education, and program evaluation. He is also actively engaged in a research project designed to analyze the relationship of career decisions to cognitive and psycho-social development among adolescents and young adults.

Dr. Joe Karmos, Associate Professor at SIU-C, taught in the public schools for 14 years, both at the elementary and secondary levels. For the past eight years he has taught in the Department of Vocational Education and in the Department of Guidance and Educational Psychology. His primary teaching is with adults in an occupational education program. He also supervises Master's level interns teaching in public schools and other instructional settings.

For six years, he was Associate Director of the Comprehensive School Mathematics Program, a curriculum development project for the Office of Education and the National Institute of Education. For another two years he worked as evaluator for that math program. In 1980, he co-directed a 12 month teacher training program for elementary school teachers which was sponsored by the National Science Foundation.

Dr. Karmos has extensively published in the areas of self-esteem, locus of control, responsibility, egocentrism, and communication skills. He also has just recently published the book Help for Job Hunters.

Cheryl A. Presley, Researcher, Department of Educational Psychology, has taught both in the public schools and at the college level in the Department of Curriculum Instruction and Media, where her assignment was teacher education.

Currently Ms. Presley is a doctoral student in the Department of Educational Psychology specializing in counseling. Since 1981, Ms. Presley has served as a consultant for various grants, made numerous presentations dealing with training parents to work with adolescents, served as a counselor in the Adult Outpatient division of the Community Mental Health Clinic, assisted in developing a model and training volunteers for crisis phone intervention, served as a member of the Crisis go-out team for Jackson County, and made presentations of the model developed by the grant to various counselors and vocational educators.

Ms. Presley has published in the area of self-esteem and school achievement, parent involvement and training, and crisis training as well as computer software for use in the classroom.

Resource Listing:

a. Material Resources: Resources obtained through this project have been added to the library of the Department of Vocational and Technical Education.

b. Human Resources: Aside from the project staff, many people contributed valuable time, information, support, and feedback to the "Strategies and Procedures for Introducing Change Skills into Vocational Programs" project. Among them are:

Dr. Susan Raymond
Center for Public Resources
New York, NY

Professor James Greenan
Dept. of Vocational & Technical Education
College of Education
University of Illinois
Urbana-Champaign, IL

Don Koleson
Assoc. Dean of Tech Ed.
Belleville Area College
2500 Carlyle Rd.
Belleville, IL

Pat Morgan
Chicago United
6 N. Michigan Ave.
Chicago, IL

Phil Viso
Assistant Superintendent
Chicago Public Schools
Chicago, IL

Tom Boldrey
Kinetic Systems Corporation
11 Maryknoll Dr.
Lockport, IL

John Cassani, Director
Northwestern Illinois Career Guidance Center
1515 S. 4th Street
DeKalb, IL

Shel Weisman, President
Consulting Pathways
Sacramento, CA

In addition, the administrative council of the Department of Adult Vocational and Technical Education, directors of the 12 Regional Guidance Centers, the public schools, and counselors of displaced workers have each in their own way contributed time, suggestions and recommendations regarding project activities. The input of all contributors was significant to the growth and success of the project.

Major Accomplishments and Significant Findings of the Project:

The major accomplished goals and objectives were:

1. Developed and presented a conceptual model which provided a rationale for introducing change skills instruction into vocational programs.
2. Identified, organized and introduced strategies for teaching change skills.
3. Identified procedures for teaching change skills in vocational programs.
4. Produced a technical and final research report.

5. Produced a report for the National Center for Research in Vocational Education which synthesized accomplishments of goals 2 and 3.

The Major Activities and Events:

The major activities and events which led toward the attainment of the project goals and objectives include:

Objective 1: Develop and present a conceptual model which provides a rationale for introducing change skills instruction into vocational programs.

1.1 The entire staff expanded efforts to gather and synthesize data and research which was relevant to formulation and development of the conceptual model.

1.2 A visual representation of the model was developed and categories of skills identified.

1.3 The staff identified programs which were appropriate to the skills attainment of the conceptual model. This was attained through library research, personal contact and networking of individuals with information.

1.4 Based upon recommendations of advisory committee and feedback from presentations, massive staff efforts went into revision and expansion of the conceptual model, both theoretical and visual.

1.5 Produced overheads, posters and a slide program which elucidated the conceptual model for presentation purposes.

1.6 Presented the model to DAVTE in Springfield. This presentation was made by Harry Daniels and attended by the entire staff.

1.7 Presented the visual representation of the conceptual model to the American Association of Counseling and Development in Houston, Texas. This presentation was made by Cheryl Presley.

1.8 Submitted a proposal paper entitled "Preparing Students to Adapt with Change: Toward a Pretechnical Curriculum" by Harry Daniels, Joseph Karmos, and Cheryl Presley to the National Center for Research in Vocational Education at Ohio State University. This paper was accepted and awarded a prize.

1.9 Prepared and submitted for publication an article to Threshold magazine. This article was solicited by the editors and is entitled "Basic Skills for Work and Living: A Model for Self-Empowerment" by Joseph Karmos, Cheryl Presley, Harry Daniels, and Ann Karmos

1.10 A presentation of the model was made to Illinois Vocational Association in Springfield. This presentation was made by Joe Karmos and Harry Daniels and attended by Cheryl Presley.

1.11 Made a presentation of conceptual model to Triton College, Chicago, Illinois and Plainfield High School Vocational Education Faculty. These presentations generated feedback for revision of the model and were made by Harry Daniels, Joseph Karmos, and Cheryl Presley.

1.12 Served as a member of North Central Evaluation team for Anna-Jonesboro High School. This was accomplished by Cheryl Presley.

1.13 Established a laison between Jim Greenan and our advisory committee which is comprised of various members of the educational and business communities.

1.14 Made a presentation to Horizon, counselors of displaced workers, which elucidated methods of using change skills with clients.

Objective 2: Identified, organized and introduced strategies for teaching change skills.

2.1 Researched literature relevant to the skill categories identified in the conceptual model.

2.2 Identified programs which exist that teach the identified change skills.

2.3 Contacted Ron LeConte, University of Connecticut regarding listening skills program.

2.4 Reviewed Edward deBono School of Thinking Skills Program from New York.

2.5 Contacted Labor Institute of Public Affairs in Washington regarding their retraining program.

2.6 Contacted and exchanged information with Shel Weisman, President, Consulting Pathways Sacramento, California, regarding curriculum materials utilized by California state school system which address skill categories identified by this grant.

2.7 Contacted Bob Swan, California State University, regarding transition training programs developed for school system.

2.8 Identified skills necessary for training for transition and synthesized current efforts in that area.

2.9 Reviewed numerous problem solving programs from various sources and identified elements of programs most applicable to vocational edcuation.

2.10 Four presentations were made to the Mt. Vernon Conference regarding a training model for utilizing parents in assisting their children in basic skill reinforcement.

2.11 Matched existing programs designed to teach problem solving and transition skills with identified skill catagory

Objective 3: Identified procedures for teaching change skills in vocational programs.

3.1 Compiled, assessed and revised information from various sources which contained information pertinent for adoption by vocational educators.

3.2 Updated and integrated information with advisory committee, Peter Seidman, and Jim Greenan.

3.3 Synthesized existing programs which address suggested procedures for instruction of transition and problem solving skills.

3.4 Prepared a technical report for the state of Illinois which contains suggestions and procedures for implementing change skills in the vocational education program.

3.5 Met with advisory committee in order to solicit feedback and refinement of implementation strategies based on their expertise in the area of vocational education.

3.6 Produced a document for the National Center for Research in Vocational Education which elucidates the model and procedures and strategies for teaching change skills in vocational education.

Objective 4: Assess the extent to which vocational educators are already utilizing the procedures for change skill instruction.

4.1 Identified a population of vocational educators to be assessed relative to attainment of Objectives I, II, & III.

4.2 Began construction of instrument design to assess the extent to which vocational educators are utilizing change skills instruction.

4.3 As a result of consensus opinion of the Project Administrator, Project Directors and Advisory Committee this objective will be delayed until a future date in order to allow more time for project efforts to be utilized in construction, refinement and dissemination of the model.

Objective 5: Produce a final report.

5.1 Met with project directors and administrators for the purpose of updating and integrating information.

5.2 Produced (3) quarterly reports which followed time-line data relative to writing report.

5.3 The entire project staff met weekly to up-date, integrate and revise project goals and assess progress.

5.4 Wrote draft technical and draft final report.

5.5 Sent the draft reports to DAVTE personnel for review and critique.

5.6 Based upon input from DAVTE personnel, produced a final and technical report.

Illinois State Board of Education

Department of Adult, Vocational and Technical Education
Research and Development Section

Product Abstract

1. Title of material "TENTATIVE FRAMEWORK FOR TRANSITION SKILLS TRAINING IN VOCATIONAL CURRICULA"
2. Date material was completed June, 1984
3. Please check one: New material X Revised material ____ Field-tested material ____
4. Originating agency Southern Illinois University

   Address Dept. Educational Psychology, Carbondale, Il. 62901 Zip Code ____
5. Name(s) of developer(s) Cheryl Presley, Joseph Karmos, Harry Daniels

   Address Same as above Zip Code ____
6. Developed pursuant to Contract Number R31-24D-036

---

7. Subject Matter (Check only one according to Department of Education Code):

Code

____ 01 Agricultural Education
____ 03 Business and Office Education
____ 04 Distributive Education
____ 07 Health Occupations Education
____ 09 Home Economics Education
____ 10 Industrial Arts Education
____ 16 Technical Education
____ 17 Trade and Industrial Education
____ 22 Cooperative Education
____ Career Education
X Other (Specify) New Basics

---

8. Education Level:

____ Pre-K Thru 6 X 7-8 X 9-10 X 11-12
X Post-Secondary X Adult X Teacher (Pre-service)
____ Administrator (Pre-Service) ____ Other (Specify) ____

---

9. Intended for Use By:

X Student X Classroom Teacher X Local Administrator
X Teacher Educator X Guidance Staff X State Personnel
____ Other (Specify) ____

---

10. Student Type:

X Regular X Disadvantaged X Handicapped
____ Limited-English Proficiency X Other (Specify) Adult

---

11. Medium and Format of Materials:

X HARDCOPY ____ VIDEOTAPE ____ FILM ____ MICROFICHE

No. of pages 24 ____ Minutes ____ Minutes ____ B & W
____ Paper bound ____ B & W ____ B & W ____ Color
____ Hard bound ____ Color ____ Color
____ Loose-leaf ____ inches ____ mm
Photos: Yes ____ No ____
Diagrams: Yes ____ No ____

BEST COPY AVAILABLE

___ SLIDES

No of frames ___
___ B & W
___ Color
___ Audio
___ Carousel provided
___ Other packaging used
(Specify) ___

___ FILM STRIPS

No of frames ___
___ B & W
___ Color
___ Audio

___ AUDIO

___ Automatic synch
___ ___ Hz
___ Manual cue
___ Reel
___ Cassette
___ Cartridge

___ OTHER

Specify:
___
___
___

---

12. Availability:

___ One copy free
___ In ERIC system (No. ___)
For sale @ $ ___ per copy
___ Not available
X Loan copy available

Contact: Name Illinois Vocational Curriculum Center Phone ( ) ___
Address Sangamon State University Zip Code 62777

13. Copyright Restrictions: In Public Domain

Contact: Name Peter Seidman Phone (217) 782-4620
Address Dept. Adult Vocational & Tech Ed.
Springfield, IL Zip Code 62777

14. What level(s) of assistance is required to provide implementation of this outcome?

X awareness
X understanding
X deciding
X implementing

15. Are Consultive/Inservice (or staff development) available? Yes ___ No ___

Contact:
Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section, E-426
100 North First Street
Springfield, IL 62777
(217) 782-4620

16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Write the description so that it can be used to promote the material. Continue on back of this sheet or on another sheet, if necessary.) See other side

17. Person Completing this Abstract: Cheryl Presley

Full Address

Dept. Educational Psychology
Southern Illinois University
Carbondale, IL Zip 62901

16. This paper proposes a framework for assisting individuals to cope and adapt with change and transitions as they occur in both the work place and educational setting. Its focus is self-empowerment of the individual through understanding and proactive management of transitions as they occur. This framework may be utilized by counselors and educators and integrated into present educational settings.

Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section

Product Abstract

1. Title of material "TENTATIVE FRAMEWORK FOR INCORPORATING PROBLEM SOLVING INTO VOCATIONAL CURRICULA"

2. Date material was completed June, 1984

3. Please check one: New material X Revised material ____ Field-tested material ____

4. Originating agency Southern Illinois University

Address Dept. Educational Psychology.,Carbondale, Il. Zip Code 62901

5. Name(s) of developer(s) Joseph S. Karmos, Ann H. Karmos, Harry Daniels, Cheryl Presley

Address Same As above Zip Code ____

6. Developed pursuant to Contract Number R31-24D-036

7. Subject Matter (Check only one according to Department of Education Code):

Code

____ 01 Agricultural Education
____ 03 Business and Office Education
____ 04 Distributive Education
____ 07 Health Occupations Education
____ 09 Home Economics Education
____ 10 Industrial Arts Education
____ 16 Technical Education
____ 17 Trade and Industrial Education
____ 22 Cooperative Education
____ Career Education
X Other (Specify) New Basics

8. Education Level:

____ Pre-K Thru 6 X 7-8 X 9-10 X 11-12
X Post-Secondary X Adult X Teacher (Pre-service)
____ Administrator (Pre-Service) ____ Other (Specify) ____

9. Intended for Use By:

____ Student ____ Classroom Teacher X Local Administrator
X Teacher Educator X Guidance Staff X State Personnel
____ Other (Specify) ____

10. Student Type:

X Regular X Disadvantaged X Handicapped
____ Limited-English Proficiency X Other (Specify) Adult

11. Medium and Format of Materials:

X HARDCOPY ____ VIDEOTAPE ____ FILM ____ MICROFICHE

No. of pages 65 ____ Minutes ____ Minutes ____ B & W
____ Paper bound ____ B & W ____ B & W ____ Color
____ Hard bound ____ Color ____ Color
____ Loose-leaf ____ inches ____ mm
Photos: Yes ____ No ____
Diagrams: Yes ____ No ____

___ SLIDES
No of frames ___
___ B & W
___ Color
___ Audio
___ Carousel provided
___ Other packaging used
(Specify) ___

___ FILM STRIPS
No of frames ___
___ B & W
___ Color
___ Audio

___ AUDIO
___ Automatic synch
___ Hz
___ Manual cue
___ Reel
___ Cassette
___ Cartridge

___ OTHER
Specify:
___
___
___

12. Availability:

___ One copy free
___ In ERIC system (No. ___)
For sale @ $ ___ per copy
___ Not available
X Loan copy available

Contact: Name Illinois Vocational Curriculum Center Phone ( ) ___
Address Sangamon State University Zip Code 62777

13. Copyright Restrictions: In Public Domain

Contact: Name Peter Seidman Phone (217) 782-4620
Address Dept. Adult Vocational & Tech. Ed. Zip Code 62777
Springfield, IL

14. What level(s) of assistance is required to provide implementation of this outcome?

X awareness
X deciding
X understanding
X implementing

15. Are Consultive/Inservice (or staff development) available? Yes ___ No ___

Contact:
Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section, E-426
100 North First Street
Springfield, IL 62777
(217) 782-4620

16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Write the description so that it can be used to promote the material. Continue on back of this sheet or on another sheet, if necessary.): See other side

17. Person Completing this Abstract: Cheryl A. Presley

Full Address

Educational Psychology Dept.
Southern Illinois University
Carbondale, IL 62901 Zip ___

16. This paper proposes a five step model for problem solving which is seen as being applicable across setting and situation. The model is expanded with example problems of interest to vocational educators. Also, the model is applied to Interpersonal problem solving for both individuals and groups.

Illinois State Board of Education

Department of Adult, Vocational and Technical Education
Research and Development Section

Product Abstract

1. Title of material "THE DEVELOPMENT OF A MODEL, STRATEGIES AND PROCEDURES FOR INTRODUCING CHANGE SKILLS INSTRUCTION INTO VOCATIONAL PROGRAMS"

2. Date material was completed June, 1984

3. Please check one: New material X Revised material ____ Field-tested material ____

4. Originating agency SOUTHERN ILLINOIS UNIVERSITY

Address Dept. Ed. Psych., Carbondale, Il. 62901 Zip Code ____

5. Name(s) of developer(s) M. Harry Daniels, Joseph S. Karmos, Cheryl A. Presley

Address Same as Above Zip Code ____

6. Developed pursuant to Contract Number R31-24D-036

7. Subject Matter (Check only one according to Department of Education Code):

Code

____ 01 Agricultural Education
____ 03 Business and Office Education
____ 04 Distributive Education
____ 07 Health Occupations Education
____ 09 Home Economics Education
____ 10 Industrial Arts Education
____ 16 Technical Education
____ 17 Trade and Industrial Education
____ 22 Cooperative Education
____ Career Education
X Other (Specify) New Basics

8. Education Level:

____ Pre-K Thru 6 X 7-8 X 9-10 X 11-12
X Post-Secondary X Adult X Teacher (Pre-service)
____ Administrator (Pre-Service) ____ Other (Specify) ____

9. Intended for Use By:

____ Student ____ Classroom Teacher X Local Administrator
X Teacher Educator X Guidance Staff X State Personnel
____ Other (Specify) ____

10. Student Type:

X Regular X Disadvantaged X Handicapped
____ Limited-English Proficiency X Other (Specify) Adult

11. Medium and Format of Materials:

X HARDCOPY ____ VIDEOTAPE ____ FILM ____ MICROFICHE

No. of pages 19 ____ Minutes ____ Minutes ____ B & W
____ Paper bound ____ B & W ____ B & W ____ Color
____ Hard bound ____ Color ____ Color
____ Loose-leaf ____ inches ____ mm
Photos: Yes ____ No ____
Diagrams: Yes ____ No ____

___ SLIDES

No. of frames ______
- ___ B & W
- ___ Color
- ___ Audio
- ___ Carousel provided
- ___ Other packaging used

(Specify) ____________

___ FILM STRIPS

No. of frames ______
- ___ B & W
- ___ Color
- ___ Audio

___ AUDIO

- ___ Automatic synch
- ___ ______ Hz
- ___ Manual cue
- ___ Reel
- ___ Cassette
- ___ Cartridge

___ OTHER

Specify: ____________

12. Availability:

___ One copy free
___ In ERIC system (No. ________)
For sale @ $ _____ per copy
_____ Not available
__X__ Loan copy available

Contact: Name Illinois Vocational Curriculum Center Phone ( ) ______
Address Sangamon State University Zip Code 62777

13. Copyright Restrictions: In Public Domain

Contact: Name Peter Seidman Phone (217) 782-4620
Address Dept. Adult Vocational & Tech. Ed. Zip Code 62777
Springfield, IL

14. What level(s) of assistance is required to provide implementation of this outcome?

__X__ awareness __X__ understanding
__X__ deciding __X__ implementing

15. Are Consultive/Inservice (or staff development) available? Yes____ No____

Contact: Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section, E-426
100 North First Street
Springfield, IL 62777
(217) 782-4620

16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Write the description so that it can be used to promote the material. Continue on back of this sheet or on another sheet, if necessary.) See other side

17. Person Completing this Abstract Cheryl A. Presley

Full Address

Dept. Educational Psychology
Southern Illinois University
Carbondale, IL 62901 Zip ______

16. This report highlights the findings and fulfilled objectives of the Adapting to Change Grant and its projected impact on Vocational Education now and in the future. Also, this report includes conclusions and recommendations based on research efforts.

Illinois State Board of Education

Department of Adult, Vocational and Technical Education

Research and Development Section

Product Abstract

1. Title of material " TOWARD A PRETECHNICAL CURRICULUM: MODELS, STRATEGIES AND TACTICS"

2. Date material was completed June, 1984

3. Please check one: New material X Revised material ____ Field-tested material ____

4. Originating agency SOUTHERN ILLINOIS UNIVERSITY

Address Dept. Ed. Psych, Carbondale, Il. 62901 Zip Code ____

5. Name(s) of developer(s) M. Harry Daniels, Joseph S. Karmos, Cheryl A. Presley

Address Same as Above Zip Code ____

6. Developed pursuant to Contract Number R31-24D-036

---

7. Subject Matter (Check only one according to Department of Education Code):

Code

____ 01 Agricultural Education
____ 03 Business and Office Education
____ 04 Distributive Education
____ 07 Health Occupations Education
____ 09 Home Economics Education
____ 10 Industrial Arts Education
____ 16 Technical Education
____ 17 Trade and Industrial Education
____ 22 Cooperative Education
____ Career Education
X Other (Specify) New Basics

---

8. Education Level:

____ Pre-K Thru 6
X 7-8
X 9-10
X 11-12
X Post-Secondary
X Adult
X Teacher (Pre-service)
____ Administrator (Pre-Service)
____ Other (Specify) ____

---

9. Intended for Use By:

X Student
X Classroom Teacher
X Local Administrator
X Teacher Educator
X Guidance Staff
X State Personnel
____ Other (Specify) ____

---

10. Student Type:

X Regular
X Disadvantaged
X Handicapped
____ Limited-English Proficiency
____ Other (Specify) Au Adult

---

11. Medium and Format of Materials:

X HARDCOPY
No. of pages ____
____ Paper bound
____ Hard bound
____ Loose-leaf
Photos: Yes ____ No ____
Diagrams: Yes ____ No ____

____ VIDEOTAPE
____ Minutes
____ B & W
____ Color
____ inches

____ FILM
____ Minutes
____ B & W
____ Color
____ mm

____ MICROFICHE
____ B & W
____ Color

___ SLIDES

No of frames ______
___ B & W
___ Color
___ Audio
___ Carousel provided
___ Other packaging used
(Specify) ______________

___ FILM STRIPS

No of frames ______
___ B & W
___ Color
___ Audio

___ AUDIO

___ Automatic synch
___ ______ Hz
___ Manual cue
___ Reel
___ Cassette
___ Cartridge

___ OTHER

Specify:
____
____
____

12. Availability:

______ One copy free
______ In ERIC system (No. ____________)
For sale @ $ ______ per copy
______ Not available
__X__ Loan copy available

Contact: Name Illinois Vocational Curriculum Center Phone ( ) ________
Address Sangamon State University Zip Code 62777

13. Copyright Restrictions: In Public Domain

Contact: Name Peter Seidman Phone (217) 782-4620
Address Dept. Adult Vocational & Tech. Ed.
Springfield, IL Zip Code 62777

14. What level(s) of assistance is required to provide implementation of this outcome?

__X__ awareness
__X__ deciding
__X__ understanding
__X__ implementing

15. Are Consultive/Inservice (or staff development) available? Yes______ No______

Contact:
Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section, E-426
100 North First Street
Springfield, IL 62777
(217) 782-4620

16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Write the description so that it can be used to promote the material. Continue on back of this sheet or on another sheet, if necessary.) see other side

17. Person Completing this Abstract Cheryl A. Presley

Full Address
Dept. Educational Psychology
Southern Illinois University
Carbondale, IL Zip 62901

16. This paper examines, expands, and clarifies the concept of pretechnical education by indentifying the body of knowledge and skills that individuals must possess to live effectively in the technological world. It includes a) a review and synthesis of core skills and knowledge that are expected by business and industry, b) a model for pretechnical curriculum, c) a framework for implementing the curricula into secondary schools, and d) a review of existing programs.

Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section

Product Abstract

1. Title of material " BUSINESS' PERCEPTIONS OF BASIC SKILLS"

2. Date material was completed Sept. 1983

3. Please check one: New material X Revised material ____ Field-tested material ____

4. Originating agency SOUTHERN ILLINOIS UNIVERSITY

Address Dept. Ed. Psych. Carbondale, Il. 62901 Zip Code ____

5. Name(s) of developer(s) Denis Junge, Joseph Karmos, Harry Daniels

Address Same as above Zip Code ____

6. Developed pursuant to Contract Number R31-24D-036

7. Subject Matter (Check only one according to Department of Education Code):

Code

____ 01 Agricultural Education
____ 03 Business and Office Education
____ 04 Distributive Education
____ 07 Health Occupations Education
____ 09 Home Economics Education
____ 10 Industrial Arts Education
____ 16 Technical Education
____ 17 Trade and Industrial Education
____ 22 Cooperative Education
____ Career Education
X Other (Specify) New Basics

8. Education Level:

____ Pre-K Thru 6
____ 7-8
____ 9-10
____ 11-12
X Post-Secondary
X Adult
X Teacher (Pre-service)
X Administrator (Pre-Service)
____ Other (Specify) ____

9. Intended for Use By:

____ Student
____ Classroom Teacher
X Local Administrator
X Teacher Educator
____ Guidance Staff
X State Personnel
____ Other (Specify) ____

10. Student Type:

X Regular
X Disadvantaged
X Handicapped
____ Limited-English Proficiency
X Other (Specify) Adult

11. Medium and Format of Materials:

X HARDCOPY
No. of pages 15
__ Paper bound
__ Hard bound
__ Loose-leaf
Photos: Yes ____ No ____
Diagrams: Yes ____ No ____

__ VIDEOTAPE
____ Minutes
__ B & W
__ Color
____ inches

__ FILM
____ Minutes
__ B & W
__ Color
____ mm

__ MICROFICHE
__ B & W
__ Color

___ SLIDES

No. of frames ______

___ B & W

___ Color

___ Audio

___ Carousel provided

___ Other packaging used

(Specify) ____________

___ FILM STRIPS

No. of frames ______

___ B & W

___ Color

___ Audio

___ AUDIO

___ Automatic synch

___ ___ Hz

___ Manual cue

___ Reel

___ Cassette

___ Cartridge

___ OTHER

Specify: ____________

---

12. Availability:

______ One copy free
______ in ERIC system (No. ______)
For sale @ $ ______ per copy
______ Not available
___x___ Loan copy available

Contact: Name Illinois Vocational Curriculum Center Phone ( ) ______
Address Sangamon State University Zip Code 62777

13. Copyright Restrictions: In Public Domain

Contact: Name Peter Seidman Phone (217) 782-4620
Address Dept. Adult Vocational & Tech. Ed. Springfield, Il 62777 Zip Code ______

14. What level(s) of assistance is required to provide implementation of this outcome?

___x___ awareness
___x___ deciding
___X___ understanding
___X___ implementing

15. Are Consultive/Inservice (or staff development) available? Yes ______ No ______

Contact: Illinois State Board of Education
Department of Adult, Vocational and Technical Education
Research and Development Section, E-426
100 North First Street
Springfield, IL 62777
(217) 782-4620

16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Write the description so that it can be used to promote the material. Continue on back of this sheet or on another sheet, if necessary.)

see other side

17. Person Completing this Abstract: Cheryl A Presley

Full Address

Dept. Educational Psychology
Southern Illinois University
Carbondale, Il 62901 Zip ______

16. This article elucidates the significant discrepancy between what skills business and industry and the level of competence the secondary school graduates bring to the workplace. The results of this survey highlight which skills will impact on the changing nature of work.

Major Dissemination Activity Summary:

Initially, the dissemination plan centered around the dissemination of products of the project, i.e., a catalog of change skills, impact statements, and reviews to appropriate audiences. It became evident, however, that it was equally important to disseminate information regarding the conceptual model of change skills and its implementation directly to the individuals who would potentially be utilizing them. This required a stepped up effort on the part of the staff to take part in various presentations both to administrators for the state, counselors of displaced workers, and educators. This process considerably enhanced the quality and refinement of the model and strengthened its potential utilitarian nature.

a) Presentations of the conceptual model were made to the Illinois Vocational Association, Horizon, Plainfield High School, American Association of Counseling and Development, the Administrative council of the Department of Adult Vocational and Technical Education, the Mt. Vernon Conference, and the Association for Teacher Education. The purpose of each of these presentations was to a) inform and increase awareness of the outcome of the project (the conceptual model), b) to increase understanding and practical application of how to utilize and implement the model, and c) to solicit feedback and reactions regarding the model itself. These presentations were made at state, national, and local meetings in the form of workshops and/or didactic presentations. The audiences were educators, administrators, counselors, and other personnel interested and invested in vocational education. Presentations were made on the average of once or twice a month for the entire fiscal year. The presentators were Dr. Joseph Karmos, Dr. Harry Daniels, Associate Professors, and Cheryl Presley, Researcher III, Department of Educational Psychology, Southern Illinois University, Carbondale.

b) Copies of the reports "Basic Skills for Work and Living: A model for Self-

Empowerment" authored by Joseph Karmos, Cheryl Presley, Harry Daniels, Ann Karmos and "Toward a Pretechnical Curriculum" by Harry Daniels, Joe Karmos and Cheryl Presley were sent to selected individuals throughout the state as well as to the National Center for Research in Vocational Education and Threshold magazine for the purpose of having them read, review, and respond to the contents of the papers. Dr. Joe Karmos, Dr. Harry Daniels, Associate Professors, and Cheryl Presley, Researcher, are in the Department of Educational Psychology. Dr. Ann Karmos, Associate Professor, is in the Curriculum Instruction and Media Department, Southern Illinois University, Carbondale.

d) Copies of the final and technical report were sent to ISBE/DAVTE to fulfill requirements for project activities. Author is Cheryl Presley, Researcher, Department of Educational Psychology, Southern Illinois University, Carbondale.

Staff Development:

The staff development activities for the project staff consisted of participation in several meetings, professional conferences and workshops. Among the workshops and conferences were:

Mt. Vernon Education Conference
Mt. Vernon, Illinois

Illinois Vocational Association
Triton College
Chicago, Illinois

Horizon
Springfield, Illinois

American Association of Counseling Development
Houston, Texas

Plainfield High School
Vocational Education Department
Plainfield, Illinois

Association of Teacher Education
New Orleans, Louisiana

World Future Conference
Springfield, Illinois

Meetings with various professionals in designated fields were attended by all or some of the project staff:

DAVTE Project Directors Conference
Sangamon State University
Springfield, Illinois

Bob Swan
California State University

Deans, College of Education
and Technical Careers
Southern Illinois University
Carbondale, Illinois

Shel Weisman
President
Counseling Pathways
Sacramento, California

John Patterson
Santa Clara Office of Education
Santa Clara, California

Jim Greenan
Project Director
Champaign, Illinois

In addition, weekly meetings were held and attended by the project staff in order to share problems, concerns, and progress.

Publicity:

Pictures were taken during the AACD conference of the conceptual model and presenter, this picture is to appear in Guideposts a monthly newspaper.

The staff was photographed and interviewed for Newsletter for Vocational Educators a paper which disseminates information about research at the University. Additionally, the project received other direct and indirect publicity through presentations at professional workshops, presentations at national and state meetings and conferences.

Problems:

Three initial concerns to the project were a) difficulty in fulfilling time constraints set by the grant due to the slowness of the system under which we operate. Information processing and generation is often time consuming and laborious when executed within the limits of the University billing and dissemination system, b) the development of a catalog of change skills instruction may be premature and more time consuming than originally thought. Emphasis, it is felt, should initially be placed on identification of strategies for teaching changeskills. This slight shift in emphasis is in response to the stated needs of both advisory committee members, DAVTE Sight directors, and Project Administrators, c) the need for hands-on materials may be causing a premature foreclosure on examination of ideas, methods and procedures being reviewed by the staff.

Development of instructional procedures is a slow task. This was seen as occuring for two possible reasons: a) receiving information for review of existing programs was out of our control and often subject to great time lapse, and b) due to the paucity of materials in existence, specifically in the Generalizable Skills and Problem Solving Skills area, it became even more essential that the review and subsequent development of instructional implementation strategies be discriminating.

Finally, it became evident that development of a questionnaire for assessment of vocational educators use of identified change skills was inappropriate to the needs and attainment of objectives of the grant at this particular time. The advisory committee, DAVTE sight directors project administrators and staff felt efforts would be more appropriately utilized in expansion, construction, refinement, and dissemination of the conceptual model. It was felt that identification and development of programs and strategies which teach these change skills to key state personnel as well as teachers and administrators was essential to the ultimate impact of the grant on vocational education. This resulted in a shift of project staff duties and in implementation of research as well as the abandonment of Objective 4 in the original policy proposal.

Statement of Impact:

We are living in the midst of a technological revolution that is influencing every aspect of our society, especially the world of work. That revolution is placing new demands on students who are currently enrolled in vocational programs. It is likely that these demands will increase in both magnitude and number for the students of tommorow. The general theme of these demands is that students will have to be more flexible, more versatile and more adaptable with respect to planning and actualizing their respective careers (Pratzner, 1978; Naisbitt, 1982).

Education in general and vocational education in particular must be prepared to respond to these demands. There is little doubt that education will be expected to play a central role in helping both current and future students respond to the need for increased career flexibility, versatility, and adaptability. For purposes of this proposal, career is defined as the series of occupations, both salaried and non-salaried, that an individual may have over his or her lifetime. This definition infers employability across the lifespan, but also recognizes that individuals may work for several different employers in their respective lifetimes.

Assisting students to increase their career adaptability will create new expectations for the schools. Students and their parents will look to teachers and other school personnel to teach them the skills that they will need to know in order to survive and prosper in the ongoing revolution. Business will expect entry level workers (high school graduates as well as graduates of vocational programs and junior colleges) to possess the skills that will enable them to contribute to corporate goals. Communities will need citizens who will be able to make difficult decisions about important issues, frequently on the basis of incomplete information. In short, education must take measures to ready itself to respond to these new expectations in an effective and efficient manner. It seems clear that the people will hold the public schools accountable for accomplishing this important task.

In sharp contrast to this undeniable need for the skills that will provide for career adaptability, there is the emerging realization of the failure of American education to provide high school graduates with a foundation in basic skills. According to the recent report of the National Commission on Excellence in Education (NCEE), "The educational foundations of our society are being eroded by a rising tide of mediocrity that threatens our very future as a nation and as a people." The NCEE cites some alarming statistics to support its statement.

- -- Some 23 million American adults are functionally illiterate by the simple test of everyday reading, writing, and comprehension.
- -- About 13% of all 17 year olds in the United States can be considered functional illiterates. Among minority youth it may run as high as 40%.
- -- Many 17 year olds do not possess the higher order intellectual skills we should expect of them. Nearly 40 percent cannot draw inferences from written material; only one fifth can write a persuasive essay; and only one third can solve a mathematics problem requiring several steps.

Despite these rather dreary statistics, however, knowledge, learning, information and skilled intellignece are and will continue to be the new raw materials of international commerce. According to the NCEE, if American students are to participate in the area of international commerce, schools must emphasize such rudiments as reading and computation as well as other essential skills such as comprehension, analysis, problem solving and drawing conclusions.

If vocational educators are to begin to address the problems associated with preparing students to adapt with the new technology, certain essential steps must be taken. Included in these steps are the following: the identification of a logical and theory based model for teaching change skills within the context of vocational programs; the initiation of practical procedures and strategies for teaching change skills that are based on the conceptual model but that can be implemented by vocational teachers.

With the completion of these central steps it is assumed that (1) vocational educators will have a better understanding of what change skills are, why they are important to the adaptive process, and how they may be integrated into vocational programs; and (2) vocational administrators will recognize the importance of including change skill instruction in vocational programs, and of their continual support for research in this vital area.

The future is where today's students will spend the rest of their lives. It is essential that educators do the best job they can in forecasting an adequate preparation for it. Five major assumptions in this preparation for the future are: (1) people will have to process more information and data than ever before, (2) human relationships will increasingly be strained as change accelerates, (3) to cope effectively with this acceleration, people will have to respond faster to and faster to the increased tempo, (4) people as individuals will need to progressively take more responsibility for their own growth and well being, and (5) self-empowerment is the key assumption for guiding schools in preparing young people for their futures.

A new balance must be struck between the impact of technology and change and the people who are affected by it. It is ultimately the individual who must apply the new techniques in the workplace. A machine, a process, a system is no more effective than the people using it. People must not become slaves of technology and change. The Human Factor in education and work must stand above all others.

Essentially, the model which has been developed represents a new paradigm for examining the relationship between education technology and employability. It has as its focus the dynamic process of adapting to change within the continually pressing demands of education, technology, and employability, and is seen as essential for an individual to achieve, maintain, and lead more meaningful, balanced and productive lives, not only for years of employment but across their lifespan.

Conclusions and Recommendations:

The conclusions of this study are based on the data presented for each of the objectives and include:

1. Present students are not good problem solvers. The worker of tomorrow, more than ever, will need to possess problem solving skills. Literature reveals that problem solving is listed by employers as an essential skill of the future.

2. The nature of work in the future will be characterized by constant change which means that workers will be employed in several different jobs within or across occupations during their lifetime. Accelerated change represents a significant factor which must be considered by individuals as they study their employability options and prepare for their initial employment.

3. The three classes of skills represent resources that are potentially available to all individuals, although in different degrees for different individuals at different occupational settings. Currently, some of these skills are being taught indirectly, however, it is seen that direct teaching of the change skills will maximize the individuals ability to proactively respond to change.

4. The change skills: Problem Solving and Transition Skills intersect with every subject matter and vocational education class. These skills typically have never been taught (Transitions) or only taught within specific content areas (Problem Solving - math, science, etc.). These skills can, and should, be taught in specific subject matter classes, but a general framework is needed which is utilizable across subjects and situations.

5. Vocational educators presently do not work closely with subject-matter teachers to insure appropriate and meaningful instruction of Problem Solving and Trans-

ition Skills. It is proposed that these skills may be taught as early as the seventh grade. It is vocational educators who have the technical know-how to lead the way in this endeavor.

Based on research findings and conclusions of this study, several recommendations can be made for practice and future research. The recommendations include:

1. For students to hold jobs, be retrained and adapt to a constantly accelerating rate of change in their lives, education must aid students in the preparation for the role of problem solvers. The effort must be undertaken to design a curricula for problem solving that would have cross-disciplinary applicability. Karmos, Daniels, Presley (1984) have developed a general model which may be the beginning.

2. These employability options both for the future and initial employment will be shaped by the aquisition and maintenance of three specific classes of skills. Three classes that have been identified are: Generalizable Skills, Problem Solving Skills, and Transition Skills.

   Generalizable Skills refer to those skills which are actively used in work performance, which are transferable across jobs and occupations and which are instrumental to success on the job and in the classroom. Examples include mathematical, reasoning, communication (written and oral), interpersonal, and attitudinal skills.

   Problem Solving Skills refer to those skills which are employed in the resolution of problematic situations including interpersonal problems (group and individual), information-related problems, and problems related to the understanding of human behavior.

   Transition Skills refer to those skills which are used to manage life transitions, especially occupationally related ones. They include managing changes in the environment, in relationships, and in oneself; managing stress, loss and grief; and making decisions.

3. Educational systems will be called upon to play a central role in educating students who can adaptively respond to changes that the future holds. Business and industry will look to the schools to produce workers who possess and manage skills which contribute to achievement of employers' goals. Education has no alternative but to respond to this demand. Education needs a comprehensive model for preparing students to adapt to change. Daniels, Karmos, Presley, (1984) have developed a model which may be a beginning.

4. All high school teachers could be trained to utilize the general model for problem solving and transition skills. The problem solving would include interpersonal and group problem solving as well as technical. Because of the many transitions students will face both in their school and work lives teachers should also be trained to teach transition skills.

5. The most important role for vocational educators relative to teaching generalizable problem solving and transition skills is through simulations. Vocational educators can develop simulations which reflect work related problems and transitions. It is seen that these simulations would span across many subject areas and substantially involve generalizable skills (reading comprehension, understanding graphs and tables, etc.) and would be a rich domain for the students to experience problems and transitions which potentially occur in an individuals work life.

ILLINOIS VOCATIONAL ASSOCIATION
An Illinois Corporation
Affiliated with the AMERICAN VOCATIONAL ASSOCIATION

October 4, 1984

Harry Daniels
Department of Psychology
Southern Illinois University
Carbondale, Illinois 62901

Dear Harry,

On behalf of the Illinois Vocational Association I want to thank you for arranging and presenting the Seminar on "Technological Changes and Human Strains" during the IVA Convention. We really appreciated it.

Enclosed is a copy of the composite evaluation from the Seminar. You and your staff should be very please with the comments. It shows a quality presentation! If you have any questions, please let me know.

We have never received your voucher for your travel and printing expenses. Did you forget to mail it? Or did it get lost in the mail? Please let me know so we can get our records cleared up.

Once again thank you for you assistance! See you in Quincy.

Sincerely

Joy Janssen

Joy Janssen
Executive Director

JJ/bt

IVA AFFILIATES: Illinois Association of Vocational Agriculture Teachers / Illinois Business Education Association / Illinois Cooperative Vocational Education Coordinators Association / Illinois Council of Local Administrators / Illinois Career Development Services Association Illinois Health Occupations Association / Illinois Industrial Education Association / Illinois Vocational Home Economics Teachers Association

IVA EXECUTIVE OFFICE
44 Emporia Avenue, Springfield, IL 62702
217/787-3751

TECHNOLOGICAL CHANGES AND HUMAN STRAINS

Total No. of Evaluations - 39
Teaching areas - Ind. Ed. - 4 Home Ec. - 16 Ag. - 2 Business - 7
Primary job - Teacher - 30 Coordinator or Director - 3 Administrator - 4
Counselor - 2

1. How was your seminar linked to business and industry?

   Learning how to use models for problem solving in change and transitions; needed more discussions on impact of modern tech.;related humanness to demands of technology and changes;info provided to help students develop personal skills;related to business and industry in that skills needed to be successful in the world of work;very much;how we can help our students adapt to changes after they leave school;problem solving, skill development;in problem solving as applied to life;personal relationship are as important as skill;teachers need all the tools they can get to help our students prepare for the world of work;problem solving is involved in all walks of life;in problem solving; all students will need a system of dealing with problems in every job;very definitely;how to deal with people in abnormal situations;a method of preparing students who through trauma or problems are not readying themselves for business and industry;problem solving techniques that students should be introduced to;related to what kind of employees business and industry want; skills employers are looking for in the people they hire;how to deal with people;how to prepare your students to cope with life on a personal level and how it would affect your job;need to prepare students with manipulative skills, reasoning skills, problem solving skills;a model which can be utilized in education to prepare people to enter business and industry;how to prepare students for change in the future business and working world;certain skills students need to face jobs in business and industry;__;by showing students how to cope with change;employers seek workers who possess problem solving and interpersonal skills;show how people could get along and work out problems using group problem solving;linked to management problem solving solutions needed in all aspects;making use of problem solving skills;we discussed methods of interpersonal and group problem solving and the need for transition training;arm students so they can take care of themselves when they leave high school;help to educate students concerning stress with change;problem solving interpersonal relationships;the importance of interpersonal skills as being important for maintaining a job;yes.

2. Were the procedures for and need to link your program to business and industry covered in the seminar?

   Yes;yes;yes;it should help myself and the students;yes;industry uses problem solving daily so we must develop students that are comfortable with the method; yes;yes;yes;yes;yes;thinking skills have got to be the most important due to the changes;yes;some;yes;yes;yes;yes;__;__;indirectly yes;yes;I feel the title was misleading;yes;yes;yes;yes;any program could be helped if the group problem solving model were used;no;it showed me a way that I can help my students;yes;yes;yes;help students solve their problems and cope with changes; yes;yes;yes;yes.

3. Will your job behavior be affected because of the content covered in the seminar?

   Yes;yes;inspires me to do better and use more resources;yes; we use many of the techniques already;yes;somewhat;yes;yes; have been using this method to some extent already;I hope so;I use the problem solving already;yes;some yes;it will enable me to deal with students from a different view;yes;yes;yes; probably to some extent;yes;probsbly not;a little;will continue;I hope so; some; to some degree;slowly but surely;I will attempt to;I hope to;I hope to;yes;yes;yes;yes.

4. Will the content of the seminar be implemented into your program?
__;Yes;yes;yes;much of this content I am already using;yes; as much as possible; __;yes;yes;yes;I already have students involved in decision making and problem solving;__;yes;some of it already is;yes;__;yes;__;__;reinforced some of the ideas I already had;unfortunately it would not be allowed but it should be;is already used;yes;yes;yes;__;hopefully;not overtly;already using some;yes;yes;yes;yes;yes;yes;yes;__;.

5. Other comments
Good program, presentors were well prepared and informative;good seminar; examples given were helpful;__;__;__;__;problem solving is nothing new; has given me some new ideas, good seminar;the title was misleading not what I expected;interesting informative good job;__;good seminar;__;very good;presentors were knowledgeable;excellent job by presentors;__;excellent; this was great;problem solving has been a part of my teaching methods;__; I feel most teachers use this material already;excellent;good to show how some DAVTE money is used;very interesting;__;a good session;__;the 3rd speaker could have had a good program;__;speakers did an excellent job of answering questions;good;good;__;very informative;__;based specifically on life skills the ability to problem solve.

6. What business and industry linked seminar(s) topics and methods of presentation would you recommend for next year?
__;would like to hear views of industry;__;a follow-up seminar on this same area;__;__;tech. changes that we need to address in teaching skill subjects;__;more seminars dealing with people;__;__;__;__;__;__;more computer related teaching aids;__;__;__;a Model-netics seminar;__;__;what direction our tech. society is going in and how do we prepare our students;staff developme self-esteem;__;__;__;__;what we can do to employ students after graduation; lates comp. based VoEd projects and methods that work, traditional classroom tech that works;computers;busniess and industry rep on what they are doing in this area;__;__;more of same;more of same;__;.

APPENDIX A

Tentative Framework for Transition Skills Training in Vocational Curricula

Cheryl Presley

Joseph Karmos

Harry Daniels

Southern Illinois University - Carbondale

TRANSITIONS

Our lives are in constant transition and people are struggling more than ever to get along with each other. There is little wonder that many Americans today would support the view that "change is avalanching upon our heads and most people are grotesquely unprepared to cope with it" (Toffler, 1970). The acceptance that change will exist across one's life-span coupled with unsettling and rapid technological advances have not only transformed present worklife, but have drastically altered the future individuals will face.

Technology is being implemented in the office, school, and factory at an ever acclerating rate and at the same time society itself is undergoing considerable social change. There are more women entering the work force, medical advances are prolonging life-span, workers are seeking fulfillment in their work, and there is increased populations, all of these changes demand the development of new technologies to support them. Never before has the interface between technology, change, and the people who use technology, been more important if our society is to prosper. A balance must be struck between the impact of technology and change and the human beings who are affected by it.

> "Human resource development is the least understood factor affecting productivity and performace and perhaps the most crucial. In an increasingly complex work world, the quality of interaction between human beings will often be a factor that distinguishes a productive business undertaking from a failing one,"
>
> House Committee on Science & Technology, (1981)

America's social capacity, the capacity to cope, adapt, and excel in an increasingly technological society is dependent on human beings ability to effect and control that technological development.

The human factor is important because ultimately it is the employees who must apply the new techniques in the workplace. A machine, a process or a system is no

BEST COPY AVAILABLE

more effective than the people operating and managing it want it to be or know how to make it.

The worker today is continually confronted with a myriad of multidimensional changes in the workplace. Traditional views of labor and management are changing as the workforce moves from a manufacturing economy to a service economy. Self-help is replacing institutional help, institutional support and care are diminishing, and changes in the generation and communication of information are transforming traditional business practices (Gibbons, 1984). The composition of the workforce is changing. New equipment is making many jobs obsolete within six months. Workers experience more stress as the reality of changing jobs or retraining as many as six to eleven times during an occupational life-span becomes more certain. To survive the worker will have to learn new ways to adapt to and new ways to communicate with those who are a part of that environment. The man-machine-change-interface is critical to successful management of the future. In considering alternatives to management of the future, decreasing the rate of change of technology may seem appealing, but this is rarely beneficial to the society as a whole. It then becomes apparent that it is the human factor to which we must turn attention.

These unsettling circumstances demand certain responses from our schools. Mainly, it is up to our educational system to prepare students to cope with these realities and to utilize education as an instrument of change through which the individual may have the resources and options to build and survive the future. The challenge for educators seems nearly overwhelming as powerful alternatives are generated by various educational interest groups. However, it is suggested that in order to maximize an individuals ability to cope, manage, and adapt to the challenge of an uncertain future, it is the responsibility of educators to identify and pass on those skills. The framework for transition education is an attempt to fulfill that perceived need.

The purpose of the framework is to provide a method of assisting individuals to cope and adapt with changes and transitions which will occur both in the work place

BEST COPY AVAILABLE

and across the life-span. It has as its focus the self-empowerment of the individual through understanding and dealing with events as they occur.

Transition Model

A transition is defined as an event or non-event resulting in a change in relationhips, routines, assumptions, or roles within the setting of self, work, family, school, health, or economics (Schlossberg, 1984, p.43).

- Identify the Transition
- Identify Coping Resources
- Identify and Choose Ways of Managing the Transition
- Trial, Integration, and Self-Transformation

Framework for Implementing Transition Education

This suggested general framework is an attempt to organize the knowledge and process necessary for maximizing an individuals ability to adapt and manage transition in a personal, interpersonal, institution, workplace, or community setting.

I. Identify the Transition:

Identification of a transition begins with the awareness of what has ended. Every transition begins with an ending (Bridges, 1980). That is, what event has occured which signals an end of the way things were. A welding student who is about to look for an entry level job is making the transition from the end of student self to the beginning of working self. The worker whose job has been eliminated as a result of technological advances faces the end of work life as they have known it and the uncertainty of job change, unemployment or retraining. In each case, identifying the ending allows the individual to proceed with further efforts to assess the problem accurately.

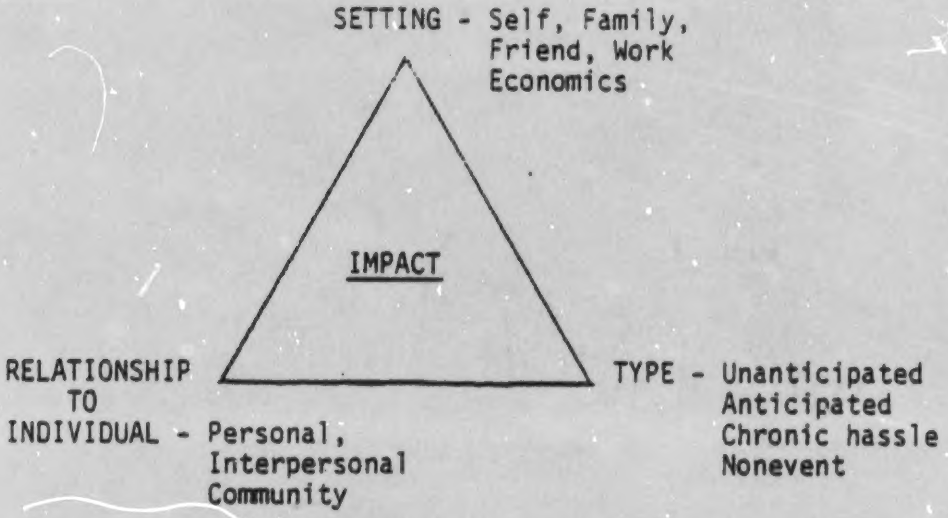
Since a transition is an event which requires a change in assumptions about oneself, it is important to assess the over all impact of the transition on one's assumptions. In order to accomplish this the individual may look to 1) the setting (within the self, family, work, health, or economics), 2) the relationship of the individual to the transition (whether its personal, interpersonal, community) and 3) the type (anticipated, unanticipated, chronic hassles, or nonevent) (Schlossberg, 1984).

The relationship of a person to the transition is central to understanding the impact of the transition on the individual. Did the event begin with the individual (quitting a job) or with another person (their loss of a job)? Is the transition personal (not getting promoted) or interpersonal (not being able to adjust to changes in the workplace, not getting along with colleagues, employees)? Does the transition involve public or community awareness (others awareness of one's unemployment may be demoralizing to an individual).

The setting in the life arena of the individual in which the life event is based (self, family, health, work, economics) allows the individual to discriminate degrees of stress that may be experienced as a result of the transition. A transition which may start out as personal and economic - lack of icome through job loss - can also affect family relationships and precipitate other transitions.

Anticipated transitions are those alterations of roles which occur predictably over a life, for example, graduating from a technical program, getting a first job. Because these events have a high likelihood of occurrence, the individual can anticipate and rehearse for them. An unanticipated transition is a nonscheduled event and generally is not predictable. Events of this type such as, being laid off, being demoted, leaving one's job for retraining, experiencing skill obolescence, are transitions which, while previously improbable, are happening to comparatively more people. The "chronic" hassle transition is characterized by its continuous and pervasive presence. This type of transition is experienced as innarmonious relationships in the work setting, conflict with co-workers, fear of plant closing over a long period of time. The chronic hassle generally goes unidentified and therefore, leads to a slow erosion of an individual's confidence and ability to cope. Nonevent transitions are those an individual counted on but didn't occur, thereby altering their life, such as a promotion that never occurs, a career change than never materializes, a retirement plan than never gains fruition because of changes in work. In these cases the non-occuring event which has been anticipated and desired, is perceived as more stressful than its occurrence and requires a reassessment of one's assumptions. Identifying the type of transition assists in assessing the degree of stress an individual might experience as a result of the transition which is typically assumed to reflect the degree of change which will occur.

Essentially, assessment of the impact of the transition on one's assumptions about relationships, roles, and routines is most critical to the mobilization and understanding of coping resources and transition management.


SETTING - Self, Family, Friend, Work Economics
IMPACT
RELATIONSHIP TO INDIVIDUAL - Personal, Interpersonal Community
TYPE - Unanticipated
Anticipated
Chronic hassle
Nonevent

II. Identifying Coping Resources

Gaining awareness of how one thinks, feels, and behaves when confronted with change sets the stage for knowing how to alter one's behavior and environment. Personal awareness' and insights an individual gains relative to those awareness' may make the difference between utilizing the transition for personal growth or experiencing deterioration. The process of coping with transitions can provide an individual with the ability to manage future transitions, as well as experiencing a renewal of directions and goals which lead to greater satisfactions than before the transition took place. The process of adapting and developing positive learning out of a distressful situation is based upon the individual's awareness of themselves in that situation. Step two is specifically designed to enhance the personal awarenesses necessary to maximize one's ability to adapt and respond to transition.

The function of identifying coping resources and responses is to help the individual regain control over the situation, the meaning, and stress of the transition. Coping response is generally referred to as the "things people do to avoid being har by life strains" (Pearlin & Schooler, 1978, p.1). It is the overt and covert behaviors which the individual may call upon to prevent, alleviate and respond to the stress of transition. When an individual experiences a transition (especially an unexpected one like job loss or retraining), the coping resources available are typically overlooked initially due to the disturbance and disorganization that occurs as a result of the transition.

The awareness of coping resources becomes central to the theme of managing transitions successfully. Effective coping means flexible utilization of a range of awarenesses and strategies as the situation demands. Identification of coping resources helps a person to make informed decisions regarding management of the transition. The coping resources fall into three categories: 1) the support system (internal and external), 2) possible and actual coping responses, and 3) impact of personal variables (ego, strength, values, health, age, sex) on the transition. As defined here the ability to cope is not a trait, but a dynamic process, constantly in flux throughout the continuing process of appraisal and understanding of available resources.

The importance of a support system may be the key to handling the stress of a transition. Essentially, people receive support from family, friends, institutions, and community services. Building and utilizing support systems involves identifying people who can provide for personal needs, seeking sources (groups, organizations) of potential support, developing strategies for spending time with persons considered helpful, and applying social skills necessary for cultivating the external support system.

An individual whose job has become obsolete due to technological advances may initially seek emotional support from a spouse or family, but, it may become necessary to extend it to a support group of others who are experiencing job displacement and who focus on the economic aspects of structural unemployment as well as options for retraining. A third support system possibility may be to increase time spent with others who can assist with managing the stress of the displacement through activities such as exercise, biofeedback, etc. Most people find it helpful to develop and utilize an external support system during stressful transitions

There is another form of support system than individuals utilize with varying degrees of success during a transition and that is the INTERNAL support system. The internal support system refers to the messages we give ourselves about our experiencing of the transition. An individual rarely realizes that a majority of supportive messages result from self-talk rather than from external sources (Brammer & Abrego, 1979). The internal dialogue which occurs throughout the day reflects the way an individual perceives and thinks about the transition; how an individual feels and behaves about a transition is affected by what and how they think. A valuable tool for managing transitions, then, is to a) identify self-talk that is occurring, b) evaluate the reasonableness of the self-talk, and c) replace inappropriate self-talk with appropriate self-talk. For example, a trained welder who is not being hired as quickly as he expects might utilize self-talk such as: "If I were a good welder, I would already be hired. I bet my training isn't good enough. I knew I should have gone into business education. I'll never get a job". Because self-talk leads individuals to behave in a certain manner, this welder may choose to a) stop looking for a job, b) jump into another profession, c) become depressed and "give-up".

It is important, then, that one recognize the distinction between realistic and defeating self-talk and to utilize the skill of supportive self-talk to help cope with difficult situations. The welder may, for example, after assessing the negative effort of his self-talk, realize that he only had gone on two job interviews and that it is not reasonable to expect to be hired that quickly. Based on a change of perception the welder may replace his inappropriate self-talk with more positive statements such as: "I feel I'm a qualified welder and I need to look further for a job".

Coping Responses:

Coping Responses can be an effective adaptation to the stress of the transition. They are the behaviors which an individual does on their own behalf when confronted with change. Pearlin & Schooler (1978) identified essentially three major responses which constitute coping strategies:

1. Responses that modify the situation or alter the source of strain (negotiation with union members, finding an alternate solution to losing job).

2. Responses that control the meaning of the problem, (difficulties at work don't exist, I'll just ignore them).

3. Responses that manage the stress (anger, hostility, depression).

The function of a Coping Response is to enable the individual to control the situation, the meaning and the stress of the transition. Individuals utilize different responses in different situations. The strategies identified by Pearlin constitute but a portion of the range of responses that individuals call upon to deal with transitions but are good descriptions of options the individual may utilize. The ability to cope is a dynamic process that is continually in flux throughout the process of going through the transition and effective coping means flexible utilization of a range of strategies as each situation demands. Utilizing awareness of the various responses one initially makes and ones that may be made as the transition progresses, identifying one's coping responses (both initial and as time passes) allows the individual to choose from a range of responses which may be more adaptive to the situation than those they are presently using.

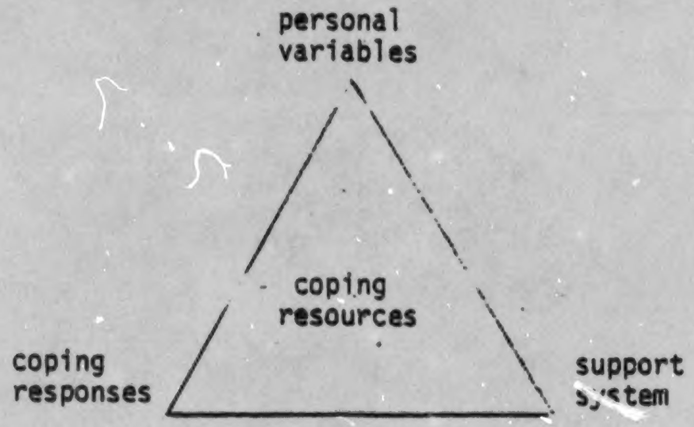
Personal Variables:

Personal variables which an individual brings to a transition bear directly on how an individual perceives, manages and assimilates the transtion. Demographics such as age, sex, health, life stage, social class, act as filters and mediate options, perceived and real, which an individual has coming to the transition.

Schlossberg (1984) reports various studies which, in the occupational arena, life strains are felt more by those in lower socioeconomic groups and women. For example, being fired, being unemployed, nonfulfillment of expectations, are found to be significantly more concentrated in that population. A women, then, who is a single head of the household of low socioeconomic status and who is fired, certainly will be impacted to a greater degree as a result of having fewer resources to fall back upon than a career women with no children whose husband is also a wage earner.

An implication of sex differences for instance is a dual career couple, where the man's work takes precedence over the woman's, and requires transfer of location. Rarely will the wife's occupational needs bring about changes in the family's situation. As can be seen demographics and personal characteristics do bear on the options an individual has within a transition, therefore, these variables need to be explored.

Psychological resources are the personality characteristics that an individual may draw upon to withstand transition. Does the individual have good communicaiton and listening skills? How much control do people feel they have of the situation? Can the individual tolerate ambiguity? Does this threaten the individual's sense of competency? People's basic values and beliefs are certainly factors which impact on their ability to assimilate a transition. The personal variables and psychological resources represent some of the ways people are when they deal with life strains. The figure below summarizes the major features of coping resources.



3. Identify and Choose Ways of Managing Transition

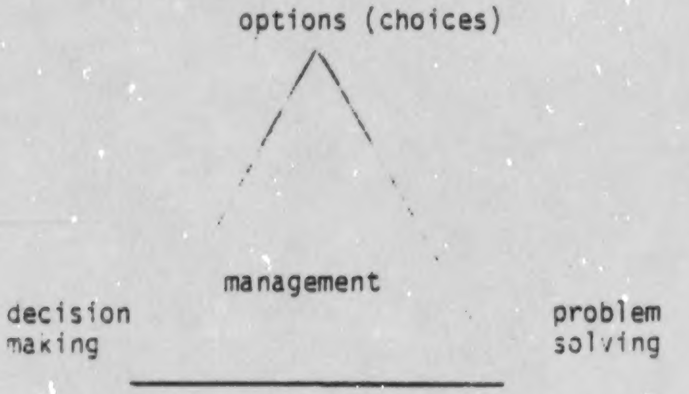
Bremmar & Abrego (1984) emphasize that because transitonal decisions differ from routine life decisions it is extremely important to make effective decisions during them. The key to making effective decisions is to be aware of options. Typically, people in transition freeze and see few options. It is essential that people going through a transition see as many alternatives as possible.

In order to examine alternatives it is suggested that the individual be introduced to a useful problem solving model. Researchers (Meichenbaum, 1977; Brammer & Abrego, 1981; Schlossberg, 1980) have supported the view that people having training in utilizing a problem solving model for transitions are able to act more realistically, meet threat more constructively, appraise the transition more accurately, and decide upon appropriate coping skills to act effectively. Active problem solving assists the individual in regaining a sense of control and competence at a time when most things are in flux.

A worker who has been displaced as a result of technological advances, essentially faces the problem of going from being employed to unemployed. At this point a general problem solving framework becomes a powerful tool for assisting in the solution. For example, the authors suggested model has five steps the worker could go through: 1) Identify the problem. The problem for the displaced worker is unemployment; 2) Consider all Alternatives. This stage is non-evaluative and relies on brainstorming (generating as many alternatives as possible), for example, retraining may be a possibility, looking for a similar job in another company, changing professions, and going on unemployment are some alternatives; 3) Choose a tentative solution or strategy. This stage is dependent upon making a tentative decision about how to solve the problem. If the worker decides that retraining might be a solution based upon a) the worker finds that he/she could stay with the company and learn new skills which would enhance employability, and b) this alternative would cause the least disruption in social support system and family life; 4) The next step is to Implement the Solution. This step includes plans for identifying "who does what, when," for implementing the solution of the problem. In this case, the worker may need to decide not only what steps need to be taken for retraining, but also what the employer needs to do and what the family needs to do during training when finances may be scarce. An important aspect of this step of the problem solving model is the evaluation of consequences of the decision. For example, if retraining is the solution, will it be a temporary one? Will it actually provide more job security? Will it be consistent with one's values and view of the career itself? Can the family survive financially and emotionally during retraining? 5) Learn., The last step of the problem solving model asks, What did you learn from what you've done?

Through utilizing the problem solving framework the individual can evaluate and identify options for managing the transition. A fine line exists between actual and perceived options and this problem solving model is seen as a way of discriminating and identifying those differences and getting on with taking some action.

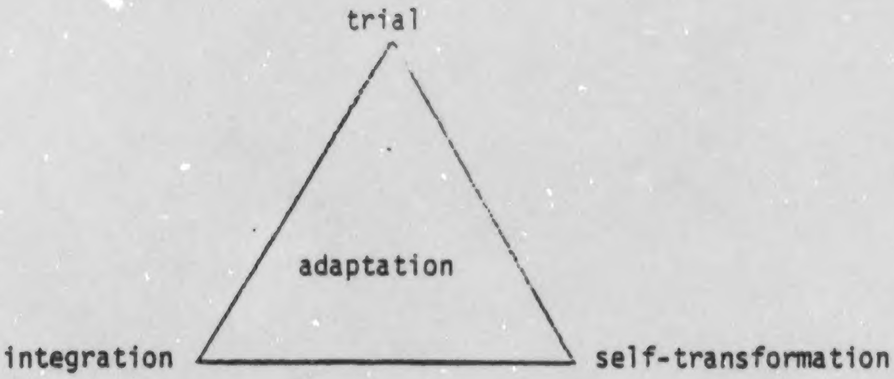
The second aspect of this stage of the framework for transitions (identifying and choosing ways of managing the transition) is the introduction of a step called the "Neutral Zone" (Bridges, 1980). This neutral zone is a time out from the highly cognitive, highly proactive method of dealing with the transition. It is a temporary state where an individual may internally assess the choices and awarenesses made in managing the transition. An electrical engineer laid off by a space-industry firm describes his experience in the neutral zone by saying he realized what looked like lack of initiative in finding another job was the actual realization that he really did't even want another job like it. To take advantage of the Neutral Zone before committing oneself to a course of action, the individual may need to identify what it is they really want, take time to be alone, and decide what is important. It can be a source of renewal amid the chaos which will make the difference between being able to reapproach the ability to work, love and play, or be destroyed by the experience. It is the passage between the old life (pre-transition) and the new (post-transition) and is a particularly rich time for insight.



IV. Trial, Integration, Self-Transformation

The transition process requires a renewal of energy in order to take shape and gain new momentum. The understanding that the beginnings of all human undertakings are untidy seems an essential component to the often rocky road of adaptation through trial and integration of change. Vocational changes which deal with money and time and impact upon every aspect of an individuals existence are much more common than previous views of careers allowed. A genuine beginning, then relies on getting ready to act. This is where an individual takes the steps to actualize the transition. It is sometimes a trial experience; for example the displaced worker will go through with training and perhaps discover that is was not ideal after all. Then there may be a neccesity for returning to step 3 of the transition model for other options. If, however, the worker finds retraining a satisfactory solution, a period of integration and self appraisal may take place. The person returns from a disengaged state to being really "with it" again. This aspect of the beginning involves a reintegration of the new identity and elements of the old one. Questions of, How am I different and what did I learn from this experience? are foundations for managing and adapting to transitions in the future.

> "Not in his goals but in his transitions man is great"
>
> Ralph Waldo Emerson



Transformation Framework Expanded

I. IDENTIFY THE TRANSITION

- What has ended? (something personal, interpersonal, family, school, friends)
- What were some of the factors that made the change occur? (people, job, school, values)
- What is the impact on you? Why is it so intense?
  - Did you anticipate the event? Is it unexpected? Will it last long?
  - In what ways does your daily life change?
  - Are your values conter to what happened?
  - What will you not be able to do that you did before?
  - Does this change how you view people around you?
- How are you viewing the transition? Can you accept change and transition as part of your life?
- What are your feelings about the transition?
- Describe the transition as best as you can.

II. IDENTIFY COPING RESOURCES

- What are your competencies? Your strengths? Your weaknesses?
- What do you know about helping yourself? What capabilities do you have that will help you?
- What personal skills are being used?
  - What personal awarenesses are important (Think about your age, sex, health, psychological resources, and sense of personal adequacy)?
  - Have your values concerning the transition been clarified?
  - Do you have good listening skills? Can you get along with people?
  - Are you thinking straight? Are your emotions getting carried away?
  - Have you exaggerated the event?

- What is your past track record for handeling a transition? Will you survive?
- What personal qualities, attitudes, resources, behaviors have you used in the past to cope?
- What obstacles do you have to overcome in order to change? (financial, psychological, interpersonal)
- Who should you talk to that could help you?
- Who could provide a personal support network? (emotional, physical, group, individual)
- What are the major steps that help you solve problems in general? Think about a problem solving model.
- What things do you have control over?
- How might you benefit or not benefit from this transition?
- What gaps are there in your support system?
- How are you reacting? (early, later)

Early Reaction: Self-Doubt and Holding on	Later Reaction: Deepening Impact and Letting Go
anxiety	depression
anger	sadness
denial	preoccupation
hostility	isolation
jealousy	withdrawl
hate	apathy

- Have you drawn a conclusion which is not supported by what is really going on?
- Are your perceptions of the situation overly simplified or rigid?

III. IDENTIFY AND CHOOSE WAYS OF MANAGING THE TRANSITION

a) Examine Various alternatives for coping

- Maybe a problem has to be solved. Use a problem solving model.
- Individual or group counseling is always a possibility.
- Is a support group available which deals with the type of transition you are experiencing?

- Will restructuring your support system help?
- Do you need to learn new coping skills? Relaxation Skills? Exercise program, time management, health care, etc.
- Have you converted negative self-talk into positive talk, when appropriate? Look for negative self-talk that prevents you from taking action.
- Examine the positive and negative consequences of all planned actions.
- Make detailed provisions for implementing or executing the chosen course of action, including contingency plans.
- Arrange temporary structures (this may include finding a temporary job, while looking for a real one).
- Reward yourself for progress.
- Sometimes a small change is effective, don't impulsively jump into large changes. Take your time.

b) Take full advantage of the "Neutral Zone"

- Find a regular time to be alone
- Identify what you really want.
- Reexamine your values and your goals.
- What is important to you? Meaningless?
- Will your solution be consistent with your values?
- Do you need to broaden your interests?
- What have you learned from the past that can help you?
- Would some "new starts" be worthwhile?

IV. TRIAL, INTEGRATION AND SELF-TRANSFORMATION

- Who can you discuss you new.plan with?
- In what ways is this a positive experience? A negative one?
- How are you different?
- What strengths did you discover about yourself?
- What did you learn from this experience?

References

Abrego, P., & Brammer, L. Developing coping skills for career-related change. Palo Alto, CA: American Institutes for Research, 1979.

Adler, M. J. The Paideia proposal. New York: Macmillan, 1982.

Ashley, W. L., Cellini, J., Faddis, C., Pearsol, J., Wiant, A., & Wright, B. Adaptation to work: An exploration of processes and outcomes. Columbus, OH: National Center for Research in Vocational Education, 1980.

Botkin, J., Dimancescu, D., & Stata, R. Global stakes. Cambridge, MA: Ballinger, 1982.

Boyer, E. L. High school. New York: Harper & Row, 1983.

Brammer, L. M., & Abrego, P. J. Intervention strategies for coping with transitions. The Counseling Psychologist, 1981, 9, 19-36.

Bridges, W. Transitions: Making sense of life's changes. Reading, MA: Addison-Wesley, 1980.

Brown, A. L. Mental orthopedics, the training of cognitive skills: An interview with Alfred Binet. University of Illinois: Center for the Study of Reading, 1984.

Center for Public Resources. Basic skills in the U.S. work force. New York: Human Resources Executive Program, 1982.

Daniels, H., & Karmos, J. Skills for adapting to change. Springfield, IL: Illinois State Board of Education, 1983.

Danish, S. J., & D'Augelli, A. R. Promoting competence and enhancing development through life development intervention. In L. A. Bond & J. C. Rosen (Eds.), Competence and coping during adulthood. Hanover, NH: University Press of New England, 1980.

DeBevoise, W. Education and technology: Predicting the needs of the future. R & D Perspectives. Eugene, OR: Center for Educational Policy and Management, 1982.

Education Commission of the States. Action for excellence. Denver: Education Commission of the States, 1983.

Fuchs, C., & Rehm, C. A self-control behavior therapy program for depression. Journal of Consulting and Clinical Psychology, 1977, 45, 206-215.

Gibbons, M. Walkabout ten years later: Searching for a renewed vision of education. Phi Delta Kappan, 1984, 65(9), 591-600.

Gisi, G. C., & Forbes, R. The information society: Are high school graduates ready? Denver: Education Commission of the States, 1982.

Goodlad, J. I. A place called school. New York: McGraw-Hill, 1982.

Goodlad, J. I. A study of schooling: Some implications for school improvement. Phi Delta Kappan, 1983, 13(6), 552-558.

Gordon, T. Teacher effectiveness training. New York: David McKay Company, 1974.

Greenan, J. P. Identification of generalizable skills in secondary vocational programs. Springfield, IL: Illinois State Board of Education, 1983.

Gould, R. Transformations: Growth and change in adult life. New York: Simon & Schuster, 1978.

Guest, R. Quality of work life. Harvard Business Review, 1979, 57(4), 76-88.

Kolb, D. A., & Baker, R. J. Employee participation groups member manual. Detroit: General Motors, 1980.

Levinson, D. J. Season's of a man's life. New York: Alfred A. Knopf, 1978.

Meichenbaum, D. Cognitive behavior modification. New York: Plenum Press, 1977.

Molitor, G. T. The information society: The path to post-industrial growth. *The Futurist*, 1981, *15*(2), 24.

Moos, R. H., & Tsu, V. Human competence and coping: An overview. In R. H. Moos (Ed.), *Human adaptation: Coping with life crises*. Lexington, MA: Heath, 1976.

Naisbitt, J. *Megatrends*. New York: Warner Books, 1982.

National Council on Excellence in Education. *A nation at risk: The imperative for educational reform*. Washington, DC: National Commission on Excellence in Education, 1983.

Pierson, G. W. *Tocqueville and Beaumont in America*. New York: Oxford University Press, 1938.

Polya, G. *How to solve it*. Garden City, NY: Doubleday Anchor Books, 1957.

Pratzner, F. C. *Occupational adaptability and transferable skills*. Columbus, OH: National Center for Research in Vocational Education, 1978.

Pratzner, F. C. The redirection of vocational education in the comprehensive high school. *Journal of Industrial Teacher Education*, 1984, *21*(3), 3-12.

Pratzner, F. C., & Ashley, W. L. *Occupational employability and transferable skills: Preparing today's adults for tomorrow's careers*. Columbus, OH: National Center for Research in Vocational Education, 1984.

Ravitch, D. On thinking about the future. *Phi Delta Kappan*, 1983, *65*(5), 317-320.

Schlossberg, N. K. A model for analyzing human adaptation to transition. *The Counseling Psychologist*, 1981, *9*, 2-19.

Schlossberg, N. K. *Counseling adults in transition: Linking practice and theory*. New York: Springer, 1984.

Schneider, J. *Stress, loss and grief*. Baltimore: University Park Press, 1984.

Selz, N. The teaching of employability skills. Columbus, OH: National Center for Research in Vocational Education, 1980.

Timpane, M. Corporations and public education in the cities. New York: Carnegie Corporation of New York, 1982.

Whimbey, A., & Lochhead, J. Beyond problem solving and comprehension. Philadelphia: The Franklin Institute Press, 1984.

Tentative Framework for Incorporating Problem Solving into Vocational Curricula

Joseph S. Karmos

Ann H. Karmos

Harry Daniels

Cheryl Presley

Southern Illinois University - Carbondale

PROBLEM SOLVING

Problem solving is receiving more national attention now than ever before. Daniels and Karmos (1983) found that except for the three R's, problem solving was listed most frequently in the literature and by employers as an essential skill for dealing with the future. Michael Timpane, in his report of corporations and public education, emphasized the need for teaching young people problem solving skills so they will be ready for further education and training (Timpane, 1982).

Roy Forbes, Director of the assessment and evaluation division of the Education Commission of the states, predicted that by 1990 between 900,000 and 2,000,000 high school graduates will not possess the problem solving skills required for employment in a highly technological society (Whimbey & Lochhead, 1984). Pratzner (1984) has stated that "The first priority is for secondary level vocational education to offer good education in reading, writing, computing, listening, and problem solving" (p. 6). Lemons (1984), from The National Center for Research in Vocational Education, concluded that the education required to prepare individuals for post-secondary education and training for high-technology occupations must include critical thinking and reasoning skills (p. xii).

Daniels, H. & Karmos, J. (1983). Skills for adapting to change. Springfield, IL: Illinois State Board of Education.

Timpane, M. (1982) Corporations and public education in the cities. New York: Carnegie Corporation of New York.

Whimbey, Arthur, and Lochhead, Jack. (1984). Beyond problem solving and comprehension. The Franklin Institute Press.

Pratzner, Frank C. (1984). The redirection of vocational education in the comprehensive high school. Journal of Industrial Teacher Education, 21 (3). 3-12.

Not enough problem solving is occurring in classrooms. In the April, 1983 *Kappan*, John Goodlad remarked that "teacher talk" was by far the dominant classroom activity. "Teachers rarely encouraged student-to-student dialogue or provided opportunities for students to work collaboratively in small groups or to plan, set goals, determine alternative ways of achieving these goals, and the like. The emphasis was on recall, not on problem solving or inquiry" (p. 552). Goodlad went on to say that each of the 50 states believes in problem-solving instruction but very few are doing much with it.

Ann Brown from the University of Illinois conducted an interview with Edward Binet (Brown, 1984) on the teaching of problem solving skills. Binet said:

> What I object to in traditional classes is that it is the teacher who produces, and the student who passively listens. Such a lesson has two faults: it does not impress the student other than by its verbal function, it gives him words instead of making him deal with actual objects, and it appeals only to his memory, reducing him to a passive state. He doesn't judge, doesn't think, doesn't invent, and doesn't produce. He needs only to retain. His aim is to repeat without mistake, make his memory work, know what is in the lecture, in the textbook and reproduce it. The results of such practices are deplorable: e.g., a lack of curiosity for what is not in the book or lecture; a tendency

---

Goodlad, J. I. (1983). A study of schooling: Some implications for school improvement. *Phi Delta Kappan*, *13* (6), 552-558.

Brown, A. L. *Mental orthopedics, the training of cognitive skills: An interview with Alfred Binet*. University of Illinois: Center for the Study of Reading.

> to look for the truth only in the book, the belief that one is doing some original research by going through a book, too much respect for the writer's opinion, a lack of interest in the world and the lessons it gives, a naive belief in the power of simple formulas, a difficulty to adapt oneself to contemporary life, and above all, a static regimentation unwelcome at a period when social evolution is so fast. (pp. 14-15).

Something is being done about problem solving by business and industry. General Motors is currently training approximately 50 percent of its employees in problem solving skills. Kathy Long, Director of Research and Development for GM, said in a personal interview (1983) that the training has been successful, that productivity and positive attitudes have both increased, and that General Motors is going to devote more time and money to problem solving training. The training has improved worker competency, enabled workers to diagnose and solve job-related problems, taught them to examine their own behavior and consequences of it, and has helped workers to be more cooperative with each other in solving problems (Guest, 1979). The Center for Public Resources, in its report Basic Skills in the United States Work Force (1982), identified other corporations and also schools which are currently involved in problem solving training.

A Model for Problem Solving

For students to hold jobs, to be retrained and in general to adapt to a constantly accelerating rate of change in their lives, they will need

---

Guest, R. (1979). Quality of work life. Harvard Business Review, 57 (4) 76-88.

Center for Public Resources (1982). Basic skills in the U.S. work force. New York: Human Resources Executive Program.

strategies for how to attack and solve problems. Possession of at least one general model for solving problems is one essential strategy. There are many different models. The one we have developed is given below. It is based on problem solving models from General Motors (Kolb & Baker, 1980), from G. Polya's book How to Solve It (1957), and from Thomas Gordon's book Teacher Effectiveness Training (1974). Our model has five steps.

Five Step Model for Solving Problems

1. Understand the Problem
   - If people are involved, then there should be explicit agreement among the people on what the problem is.
   - If appropriate, analyze the problem for possible causes. (In mathematics causes are usually not involved.)
2. Brainstorm for Possible Solution Strategies
   - No evaluations or judgments should occur here. This should be a free-wheeling act of generating ideas.
3. Choose a Tentative Solution Strategy
   - For "people" problems, consequences of behaviors and solutions must be carefully considered.
   - If people are working out an interpersonal problem, then the tentative strategy will likely be a compromise.
4. Carry Out the Tentative Strategy
   - In implementing most strategies involving people, it is important to decide, "Who, does What, When."

Kolb, D. A. & Baker, R. J. (1980). Employee participation groups member manual. Detroit: General Motors.

Polya, G. (1957). How to solve it. Garden City, N. Y.: Doubleday Anchor Books.

Gordon, T. (1974). Teacher effectiveness training. New York: David McKay Company.

5. Learn

- Immediately and over time think about what can be learned from the experience. What are the implications of what has been done?
- If appropriate, evaluate the effectiveness of the solution. (You may have to start over.)

To demonstrate the versatility of this model, consider the following three examples which have been solved by teachers, students, school administrators, and business people using the five-step model. The first problem is from a General Motors training manual. The second problem is from the Institute for the Advancement of Philosophy of Children. The third problem is taken from the 1980 Yearbook for the National Council of Teachers of Mathematics.

Example 1.

Your company has just obtained a one-year contract for delivering six truckloads of hazardous materials a month. All six trucks are enroute, and this is the first time any one of you has driven this busy road. All trucks are identical though they are loaded differently. You will make 11 more deliveries this year.

The second truck is immediately behind the first truck, which is pulling a forklift. Four other trucks are about 15 minutes behind on the same road. The first truck went under a cement underpass with no problem, but the second truck got stuck. Comparing the shipping documents you realize the first truck is carrying 400 containers weighing 50 pounds each. The second truck carries 300 larger containers that only weigh 40 pounds each. The cargo is on pallets. There is an open truck service station ahead. It has a fully equipped wrecker for servicing trucks on the highway. All the trucks must arrive at the destination 20 miles ahead within one hour or your company will

BEST COPY AVAILABLE

have to pay penalties. There is an alternate route behind you but it is 10 miles longer with equally heavy traffic. You are members of the crew driving the stuck truck. What will you do?

Example 2.

Your best friend won't graduate if she doesn't turn in a long overdue paper. But she's got some kind of hang-up about it and can't write it, so now the two of you are wondering if maybe you should write it for her. You have a number of options. Which one would you choose?

Example 3.

James and Judy both work part-time in a cafeteria that is open seven days a week. James works one day and then has three days off before he works again. Judy works one day and then has four days off. James works this Monday and Judy works this Tuesday. Show the days that James and Judy will work on the same day.

At the beginning, we have our students follow the Five Step Model, step by step. Later on they are encouraged to freely use their own creativity and intuition to solve problems since no single model is directly applicable to all problems.

The Five Step Model is currently being used by students for their academic work and for their interpersonal lives. But is the mode also practical for the work place? The answer is "yes". Students use it in their part-time jobs, and General Motors uses it to get people to work together to solve problems. Employees cooperate in GM's Employee Participation Groups to solve on-the-job problems. In a 1983 personal interview, Kathy York of GM's Research and Development Division stated that competition among workers often turns out to be a liability. "They work separately against each other. We need our employees to work together to solve problems. That will increase their job competence." The problems that the groups focus on are not generally psychological ones; they are job-related problems. Workers, supervisors, managers, and executives get involved in the groups. Whoever is being affected by the problem or the solution is in the group. They use a model very similar to the Five Step Model.

The Need for Transfer

For general problem solving, a model is necessary but it is not sufficient. Transfer is one of the deficiencies. Schools teach problem solving, but most students have difficulty transferring their problem solving capabilities from one setting to another (Johnson, 1984; Snowman, 1984). A recent experience made this "breakdown in transfer" more meaningful to us. We were conducting a workshop on problem solving skills and during the last half of the workshop a high school math teacher who systematically uses Polya's problem solving model remarked that he did not know what he was going to do about equipment and visuals since his school's budget had declined each of the past three years. There was a slight pause, then one of the workshop participants asked. "Have you thought about applying your problem solving model to that problem?" The teacher said, "No." Why didn't this math teacher transfer his problem solving skills from math to the situation of a reduced budget and probably less math equipment? We believe there are two major reasons for lack of transfer:

1. Not enough diverse kinds of problems are given to students to encourage transfer over a wide range of settings. Only math problems are given, or science problems, or social studies

BEST COPY AVAILABLE

Johnson, Tony W., Philosophy for children: an approach to critical thinking, Phi Delta Kappa Educational Foundation, Bloomington, IN, 1984, p. 10

Snowman, Jack, "Learning Tactics and Strategies," in Cognitive instructional psychology: components of classroom learning, edited by G. D. Phye and T. Andre, 1984, Academic Press, pp. 10-11, in press.

problems, etc. These are context bound problems. They are too similar to each other. There many commercial programs for teaching problem solving, and they provide a wide variety of problems. The June 1983 issue of the Kappan listed more than 30 programs, video-taped presentations, computer-assisted instruction, instructional programs for teachers, and materials for student use. Other excellent sources are:

- The Edward deBono School of Thinking, P. O. Box 711, Larchmont, N. Y. 10538.
- Institute for the Advancement of Philosophy for Children, Montclair State College, Upper Montclair, N. J. 07043.
- The Productive Thinking Program from the Charles E. Merrill Publishing Company in Columbus, Ohio.
- Problem Solving and Comprehension by Arthur Whimbey and Jack Lochhead, The Franklin Institute Press, Philadelphia, 1979.
- More Life Skills by Joan Hearn, Advanced Development Division, Employment and Immigration, Ottawa, Canada K1A 0J9, 1982.
- Problem Solving in School Mathematics, 1980 Yearbook, National Council of Teachers of Mathematics, Reston, VA
- Instrumental Enrichment by Reuven Feuerstein, University Park Press, Baltimore, 1980.
- The New MCAT Student Manual (Quantitative Skills) from the Association of American Medical Colleges, Washington, D. C., 1984.

- Medical College Admission Test (Quantitative Skills) by Morris Bramson and Lawrence Solomon, Arco Publishing, Inc., N. Y., 1982.
- A Complete Preparation for the New MCAT, Vol. II (Quantitative Skills) by Beryl Brain, Drew Love, and Philip Kelleher, Health Professional Education Service, Inc., Bethesda, MD, 1981.

If Molitor (1981) is right in his predictions that by the year 2000 76% of the work force will be in information/knowledge/education enterprises and other services, then the last three references will be particularly good sources of problems to prepare students for the future.

2. Most students are not explicitly taught strategies for solving problems. Some strategies are: using a model, reading information carefully, breaking the problem into manageable parts, and making a sketch. We have taught strategies to students, they have learned them, and they have improved their problem solving.

Strategies for Solving Problems

General Guidelines for Problem Solving

Guidelines from deBono. Edward deBono has formulated guidelines for good thinking and problem solving. His system has been adopted by corporate executives, taught in schools, and studied by government officials from more than a score of countries. Here are basic tools taken mostly from deBono's The Learning-To-Think Coursebook.

Molitor, Graham T. (1981). The information society: The path to post-industrial growth. The Futurist, 15 (2), 24.

deBono, E. (1982). The Learning-To-Think Coursebook. New York: Edward deBono School of Thinking.

1. Consider All Factors and Don't Limit Perceptions.

A conscious effort should be made to think of everything that might be relevant for solving the problem. Suppose you're thinking about buying a new house. Consider all factors to be sure you ask all the right questions. While obvious issues such as size, cost and layout are bound to come to mind, without a deliberate effort to list every relevant factor you might overlook others. How good is TV reception? Is there a local leash law? Can the pipes be drained quickly in case of a power failure in freezing weather?

Recall our discussion about the math teacher who didn't think about using a problem solving model from math class to help him solve the problem of a smaller budget and at the same time a need for more learning resources. He limited his point of view--he had access to more than he was using. This is not uncommon for problem solving. Try this experiment: look around the room for red objects. (Don't read on until you've done so.) Now close your eyes and ask yourself how many green objects there are. Look again. Surprised? It was your focused attention on red that kept you from noticing things of another color.

Even after using various tools of thought, you may not have found a satisfactory solution to your problem. The key to finding alternatives is to look for possibilities outside your usual thinking patterns. Edison, in searching for a light-blub filament, tried thousands of unlikely materials including cork, fishing line and tar, before succeeding with a strip of carbonized cardboard.

2. Consequences and Sequels.

One of the traits that makes us different from animals is our ability to imagine the outcome of our actions. But we can greatly improve this ability by learning to use it in a systematic way. The deBono technique is to imagine the probable outcome of a decision at four distances in the future: immediate, short term (1 to 5 years), medium term (5 to 25 years) and long

BEST COPY AVAILABLE

term (over 25 years). By weighing the consequences of thoughts and actions, people can be less impulsive and make better decisions for themselves, based upon careful thought and not on quick emotion.

3. Aims, Goals, Objectives.

An often unused tool of better thinking is the practice of making a list of reasons for doing a particular thing. Often people assume they know what their goals are, but often they have hidden or unconsidered goals that get in their way. Also, people will often just "act out" without considering whether the behavior will get them what they want.

Setting priorities and goals can help people be more efficient. Sometimes there are so many things to do that it is overwhelming. To sit down and list the first priority, then the second, etc., can help the tasks become manageable.

Defining goals can also help lead to creative solutions to problems. DeBono tells of a grandmother trying to knit while her yarn was being tangled by the family toddler. Exasperated, she put him in his playpen, but he howled so loudly that she had to take him out. Then she realized that her goal wasn't to pen the child, but to separate him from her yarn. So she solved the problem by leaving him out--and climbing into the playpen herself.

4. Other Points of View.

Often problems involve a conflict with someone such as a friend, parent, boyfriend, or girlfriend. It is the mark of a good problem solver to be able to find a solution that will agree with the other person's viewpoint. It is particularly difficult to do when one is upset or angry. But if you can take another person's point of view at such times, then you have one of the major skills of good problem solvers.

DeBono tells of an incident where he bought a new car radio from a dealer who recommended it highly. It proved no better than the one it replaced. He was about to charge into the dealer's store and demand his money back, but it occurred to him to put himself in the dealer's place. Doing this,

BEST COPY AVAILABLE

deBono saw how offended he'd be at having his judgment questioned. So he took a different tack and appealed to the dealer's sense of self-respect. The dealer exchanged the radio for a much better one, without charging the difference.

Guidelines from Whimbey and Lochhead. An additional set of guidelines for problem solvers is given by Arthur Whimbey and Jack Lochhead in Problem Solving and Comprehension. They describe the beliefs, practices, and tendencies of good problem solvers, and also the characteristics of poor problem solvers.

1. Positive Attitude.

Good problem solvers have a strong belief that academic reasoning problems can be solved through careful, persistent analysis. Poor problem solvers, by contrast, frequently express the opinion that "either you know the answer to a problem or you don't know it, and if you don't know it you might as well give up or guess." Poor problem solvers haven't learned that a problem may at first appear confusing and that the way to work the problem can be gradually analyzed and solved. Poor problem solvers lack both confidence and experience in dealing with problems through gradual and sometimes lengthy analysis. Problem solving progresses one step after another until the problem is solved.

2. Thoroughly Understanding the Data and the Problem.

Good problem solvers take great care to understand the facts and the relationships in a problem fully and accurately. They are almost compulsive in checking whether their understanding of a problem is correct and complete. By contrast, poor problem solvers generally lack such an intense concern about understanding. For example, good problem solvers sometimes reread a problem several times until they are sure they understand it. Poor problem solvers,

BEST COPY AVAILABLE

Whimbey, A. & Lochhead, J. (1979). Problem Solving and Comprehension. Philadelphia: The Franklin Institute Press.

on the other hand, frequently miss a problem because they do not know exactly what it states. Poor problem solvers have not learned how important it is to try to be completely accurate in understanding all of the ideas of a problem.

In our problem solving classes we give students many problems which involve tabular and graphical data. We are surprised at the number of students that do not carefully analyze the given data before starting to solve the problem. Instead, they just jump in and then jump to conclusions. It's a lethal habit. Focused effort must be made at the beginning to identify key information and eliminate extraneous data.

3. Breaking the Problem into Parts.

Good problem solvers have learned that analyzing complex problems and ideas often consists of breaking the ideas into smaller steps. They have learned to attack a problem by starting at a point where they can make some sense of it, and then proceeding from there. In contrast, poor problem solvers have not learned the approach of breaking a complex problem into sub-problems--dealing first with one step and then another.

4. Avoid Guessing.

Poor problem solvers tend to jump to conclusions and guess answers without going through all the steps needed to make sure that the answers are accurate. Sometimes they make intuitive judgments in the middle of a problem without checking to see whether the judgments are correct. At other times they work a problem part of the way, but then give up on reasoning and guess on an answer. Good problem solvers tend to work problems from beginning to end in small, careful steps.

The tendency for poor problem solvers to make more errors--to work too hastily and sometimes skip steps--can be traced to the three characteristics already discussed. First, poor problem solvers do not strongly believe that persistent analysis is an effective way (in fact the only way) to deal with problems. Thus their motivation to persist in working an entire problem

BEST COPY AVAILABLE

precisely and thoroughly, until it is completely solved, is weak.

Second, poor problem solvers tend to be careless in their reasoning. They have not developed the habit of continuously focusing and checking on the accuracy of their conclusions. And third, they have not learned to break a problem into parts and work it step-by-step. As a result of these three characteristics, poor problem solvers have a strong tendency to make hasty responses as they work academic reasoning problems, causing errors in both simple computations and in logic.

5. Activeness in Problem Solving.

The final characteristic of good problem solvers is the tendency to be more active than poor problem solvers when dealing with problem solving. Put simply, they do more things as they deal with a problem. For example, if a written description is hard to follow, good problem solvers may try to create a mental picture of the ideas in order to "see" the situation better. If a presentation is lengthy, confusing, or vague, they try to pin it down in terms of familiar experiences and concrete examples. Furthermore, they will ask themselves questions about the problem, answer the questions, and "talk to themselves" as they try to clarify their thoughts. They may try a flow-chart, brainstorm for possibilities, write on the problem, make diagrams, or use other physical aids to thinking. All in all, good problem solvers are active in many ways which help them get a clearer understanding and how to progress through them.

BEST COPY AVAILABLE

The Problem Solver's Knowledge Base. Robert Glasser (1984) stated that the knowledge of novice problem solvers is organized around the literal objects explicitly given in a problem statement. Experts' knowledge, on the other hand, is organized around principles and abstractions that subsume these objects. These principles are not apparent in the problem statement but derive from knowledge about the things in the problem or the subject matter associated with the problem. The problem-solving difficulty of novices can be attributed largely to the inadequacies of their knowledge bases and not to limitations in their processing capabilities, such as the inability to use problem-solving strategies. "Current studies of high levels of competence support the recommendation that a significant focus for understanding expert thinking and problem solving and its development is investigation of the characteristics and influence of organized knowledge structures that are required over long periods of time" (p. 99).

For example, the authors have experienced for many years the difficulty even gifted students have in solving time-rate-distance problems. We believe the difficulty centers on students' lack of knowledge of the time-rate-distance characteristics of objects as they move toward and away from each other. For instance, consider this problem:

> Car A starts from a point going East averaging 60 MPH, and at the same time Car B starts West from a point 300 miles away from Car A's starting point and averages 40 MPH. How long will it take for the two cars to mee?

Many students cannot do this problem because they don't know that, when two objects start from rest and move toward each other, when they meet they will have travelled the distance they were apart at the beginning. Thus, the solution to the problem is obtained from 300 = 60t + 40t (t is for time). To give meaning to the general strategy for solving such problems, we place two students, each at opposite ends of the room and then tell them the room is 50 feet long. They are to walk toward each other and stop when they meet. After the two students meet, we ask, "What is the total distance the two students have travelled?" Most of the class now realizes that the answer

---

Glasser, Robert. "Education and Thinking", American Psychologist, Vol. 54, No. 2, pp. 93-104, February 1984.

is 50 feet. They have learned a relationship that can help them solve a whole class of problems. The knowledge learned is general and goes well beyond the specifics of this one problem. Reuren Feuerstein (1980, p. 22) sums it up very well: "It is when cognitive processes become detached from specific tasks that cognitive structures are established. These structures are of a more general nature than the learning of specific tasks and, hence, result in more adaptive behavior by the individual."

We have found that students with a wider knowledge base are better at brainstorming for solutions across a wide range of problems. They are more able to understand and construct analogies, they make more discoveries, they see patterns, and they establish new relationships.

Some Specific Problem Solving Strategies

There are other strategies that can help people become better problem solvers. The ones to be discussed here are: thinking aloud, using the trial and error method, working backwards, finding all the possibilities, and managing time. We have taught these strategies to students and have witnessed students' growth in becoming confident and skillful problem solvers.

Thinking Aloud. When using this strategy, people say aloud their thoughts while attempting to solve a problem. All mental processing, however, need not be vocalized. For example, it is not reasonable to explain the meaning of every word read for a problem. When a student is unsure of what to do, confused by an idea, or stops for some time to think about it, then some thinking aloud may be appropriate. When the strategy is used, then students should try to think aloud as much as possible. Expressing thoughts, especially at sections of a problem where difficulties or hesitancy arise, is a good way to avoid skipping steps in reasoning, jumping over important information, or being unaware of the point at which being bogged down occurred.

BEST COPY AVAILABLE

Feuerstein, (1980). *Instrumental enrichment.* Baltimore: University Park

Thinking aloud while solving problems requires practice. At first, many students find it difficult to vocalize their thoughts as they work problems. But students do get used to expressing in words the steps they take and gain confidence in "talking out" the problem in front of the teacher and other students. We use the technique in full class settings, in small groups, and in one-to-one discussions between student and teacher. The choice of setting depends on the nature of the problem, the students, and the teacher.

The following illustration was taken from John R. Hayes' book, The Complete Problem Solver (p. 56).

PROBLEM. Given Jug A which contains nine quarts; Jug B, 42 quarts; and Jug C, six quarts, how could you measure out 21 quarts?

STUDENT: Uh, the first thing is that half of Jug B is the amount you wan

TEACHER: You're right!

STUDENT: Well, you can't get 21 from just multiplying up Jug A or Jug

·You can get 18 and 18 respectively, that's as close as you can get, I guess.

·Um, so I'll try to think of different combinations that might... or deficit of the 21 quarts...and

·Nine and six are fifteen...if you took two nines and two sixes, you'd have thirty, which

·Would leave you...and pour them into the 42 container, you'd have a,

·An open space of 12, which means nothing. How about...see... now I'm

·Trying to think of how close to 42 you can get with the nine and the six quantities.

·Nine times five is 45...six times seven is 42.

BEST COPY AVAILABLE

John R. Hayes. (1981). The complete program solver. Philadelphia: Franklin Institute Press

TEACHER: You're doing fine!

STUDENT: So you can, uh...fill B with C evenly.

- If you were to take...36...um, oh, uh, six times four is 24... and if you, uh,
- What I'm trying to get rid of is, is three quarts there...

TEACHER: Good.

STUDENT: So if you were to, um...still 24. I was trying to think possibly,

- Some way of...the difference between the six and the nine is three quarts.
- I was trying to think of...a way to uh...oh, how about... You put the three, six...
- Quart quantity into the [illegible]2 bottle, which is 18, then the run off, from
- Pouring a nine into a six which is three and 18 is 21.

TEACHER: Well done!

From thinking aloud, our students have learned to listen to each other, to locate breakdowns in reasoning, to learn where the stumbling point is, to realize how different people approach the same problem, and to see more than one solution to the same problem on the blackboard at the same time. Students and teachers are often amazed at how much they can learn from each other by thinking aloud.

Trial and Error. Trial and error is often underestimated as a problem solving strategy, but it can be a key strategy in the solution of some problems. Trial and error can be applied systematically by simply trying different solutions to see if they work. More often than not, however, the search can be narrowed by taking into account relevant knowledge and, by inference, reducing the number of solutions to be tried. The following example is from

Problem Solving in School Mathematics (p. 137).

Problem

Find the smallest prime number greater than 840.

Solution

Systematic trial and error. If the problem is to find the smallest prime number greater than 840, begin with 841 and try each successive number, checking for prime divisors until a prime is found. Try 2, try 3, try 5, and so on. (An algorithm for checking this could be programmed on a programmable calculator.)

Inferential trial and error. Consider the same problem. We know that numbers greater than 840 whose units digits are 0, 2, 4, 5, 6, and 8 cannot be prime and that every third number will be divisible by 3. Thus, the first few numbers to try are 841, 847, 851, 853, 857, and 859. To see if 841 is prime we check to see if one of the primes less or equal t 841 divides 841. If it does, we repeat a similar procedure for the succeeding numbers until we find the smallest prime.

Trial and error can also be advantageous in getting a feel for a problem. Trying out a reasonable guess, even if it does not work, can give valuable information. For example, if trying to find a decimal approximation for the square root of two, one might try 1.5 (1 is too small because 1 x 1 = 1, and 2 is too big because 2 x 2 = 4). Since 1.5 x 1.5 = 2.25, 1.5 is too big, but that is valuable information because it directs the next attempt to a number between 1 and 1.5. Teachers should encourage students to make reasonable guesses at times and should specify for them the value of what was learned from the trial and error and how the error can narrow the search for a solution.

National Council of Teachers of Mathematics (1980). *Problem solving in school mathematics: 1980 yearbook*. Reston, Virginia: National Council of School Mathematics.

This same way of thinking about the information gained from an imperfect attempt can be applied to solutions of interpersonal problems. Suppose a father and his daughter are problem solving about the condition of her room, particularly about the dirty clothes on the floor and on the furniture. An idea to try might be a clothes hamper in her room. Both would agree that it is a trial solution to be evaluated, say, in three weeks. If the solution is not the right one, the attempt still will help to clarify the problem and suggest a better solution.

One roadblock to becoming a good problem solver is reluctance to take a risk. Many adults have been conditioned over the years to believe that there is some strategy or way to proceed in solving a problem that they "should" have learned, and if they can't "remember how to do this kind of problem", they simply give up. Teachers are confronted with this attitude frequently when their students complain that "we haven't had this yet." Indeed, there are many specific approaches to problems that can be learned. But good problem solvers are not hampered by the conviction that there is one one way to solve a problem. They do not rely on some outside authority, but have confidence in their own ability to generate ideas. Teachers can encourage students to become self-reliant by freeing them to make reasonable guesses and to use trial and error to gain insight into a problem.

Working Backwards. Sometimes it is easier to solve a problem by working backwards rather than attacking the problem head on. Working backwards involves a change in perspective in that the new starting point was the original goal and the original starting point the new goal. Working backwards can be helpful because problems are often easier solved in one direction than another.

As an example, consider the following problem from Moshe Rubinstein's Patterns of Problem Solving (p. 19)

> EXAMPLE. How many tennis matches of single elimination must be played by 1025 players before a winner is declared?
>
> Most of our students start at the beginning by figuring there would be initially 512 games with one player getting a bye. Next there would be 256 matches with one bye, then 128 (1 bye), 32 (1 bye), 16 (1 bye), 8 (1 bye), 4 (1 bye), 2 (1 bye), 1 (1 bye), finals. The sum of 512, 256, 123...4, 2, 1, 1 is 1024.
>
> It is much more direct and general to start from the end and view one winner and 1024 losers and note that each loser would play one losing game in a single elimination tournament. So there would be 1024 matches.

This working backwards technique not only yields a solution, it also displays a unique strategy that can be used on many problems. The solution path for this problem is more important than the answer since the path yields a general method for solving such problems--work backwards. The solution is known for any number of N players; that is N-1.

Working backwards has other useful applications. Suppose you are writing a position paper to your boss to convince her to accept a particularly crucial idea. In thinking about how to draft the paper, you might begin by working backwards and ask yourself, "What kinds of questions would she ask me? What would be her major objections? How do I keep from offending her?" By working backwards, by starting with the goal, a more convincing paper can be written.

Rubinstein, Moshe. Patterns of Problem Solving, Prentice-Hall, Inc., Englewood, N. J., 1975.

Finding All the Possibilities. Another important strategy for problem solving is to have a systematic way of listing all possible outcomes of some occurrence. The system must insure that all possibilities are listed and also that only those possibilities which "make sense" from the structure of the problem are listed. An example of an orderly way to list all possible ways for something to happen or all possible arrangements is shown below. Thinking exercises about drawing marbles from bags are useful for developing orderly ways to exhaust all possibilities and they are generalizable to a large number of actual situations.

EXAMPLE. Suppose there are four marbles in a bag, numbered 1, 2, 3 and 4.

What are all the ways to draw out the marbles if, once a marble is drawn, it is not returned to the bag? One orderly way of thinking is to actually make a list with the help of a running conversation with oneself:

"OK. Suppose I happen to take out the 1 first?"

1

"Now, I'll list all the ways if the 2 comes second. (Then later, if the 3 comes second and if the 4 comes second.) So there is 12 followed by 34 and 12 followed by 43. And there is no other way for 1 followed by 2."

1 2

1 2 3
1 2 4 3

"Now, what are all the ways for 1 first and 3 second? There is 13 followed by 24 and 13 followed by 42. And there is no other way for 1 first and 3 second."

1 3

1 3 2 4
1 3 4 2

"Finally, what are all the ways for 1 first and 4 second? There is 14 followed by 23 and 14 followed by 32. And there is no other way for 1 followed by 4."

1 4

1 4 2 3
1 4 3 2

A similar conversation goes on with oneself to generate all the arrangements when 2 is drawn first, when 3 is drawn first, and when 4 is drawn first. The results:

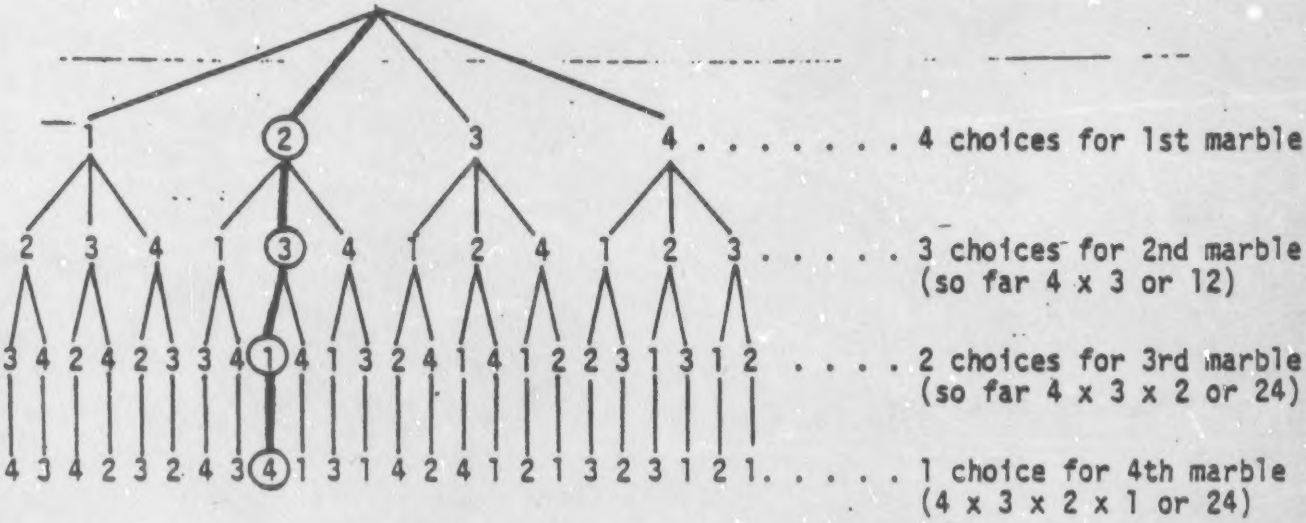
2 1 3 4
2 1 4 3
2 3 1 4
2 3 4 1
2 4 1 3
2 4 3 1

3 1 2 4
3 1 4 2
3 2 1 4
3 2 4 1
3 4 1 2
3 4 2 1

4 1 2 3
4 1 3 2
4 2 1 3
4 2 3 1
4 3 1 2
4 3 2 1

So, there are 24 ways to draw four marbles in order if the drawn marble is replaced in the bag. Every possibility is listed and there are no more.

Another skill for finding these 24 possible ways is to draw a "tree":



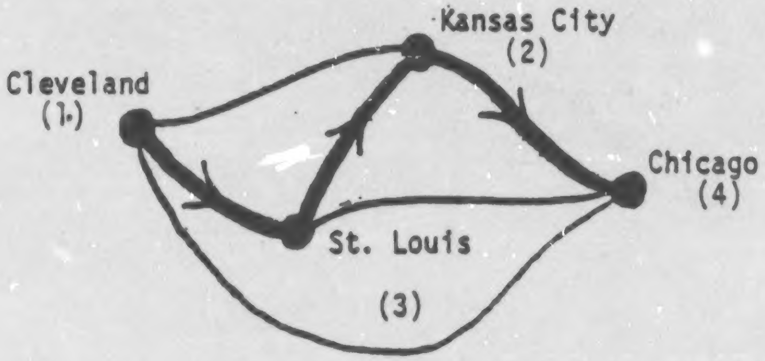
1 2 3 4
2 3 4 1 3 4 1 2 4 1 2 3
3 4 2 4 2 3 3 4 1 4 1 3 2 4 1 4 1 2 2 3 1 3 1 2
4 3 4 2 3 2 4 3 4 1 3 1 4 2 4 1 2 1 3 2 3 1 2 1
4 choices for 1st marble
3 choices for 2nd marble (so far 4 x 3 or 12)
2 choices for 3rd marble (so far 4 x 3 x 2 or 24)
1 choice for 4th marble (4 x 3 x 2 x 1 or 24)

There are 24 "paths" down this "tree" and the one that is indicated above represents the combination 2 3 1 4.

The skill of drawing a tree to determine all possibilities is an important one. Suppose all the possible ways to arrange 10 digits (without replacement as in the example above) were critical information for the solution to a problem. Listing all the possiblities would be formidable and the tree would be impractical to draw. But by reducing the problem to a simpler problem (another problem solving strategy) one could realize that there is a pattern for finding the number of combinations. The tree for the 4-digit problem makes it clear that there are 4 x 3 x 2 x 1 or 24 ways to arrange four digits. So it is logically sound to compute 10 x 9 x 8 x 7 x 6 x 5 x 4 x 3 x 2 x 1 to find the number of ways to arrange 10 digits (without replacement).

This kind of thinking is useful problem solving skill. The 4-digit problem has the same structure as figuring out, for example:

- How many different ways can 4 colors be used to paint a car if the colors for the body, the top, and two parts of the trim are arranged differently? (24 ways)
- What is the probability of drawing the "winning number" 2 1 4 3 from a box containing four chips labelled "1", "2", "3", and "4"? (1/24 or 1 of the 24 possibilities).
- How many different routes are there which reach all of 4 cities only once and which could originate in any of the four cities? (24) One such route, (1) Cleveland to (3) St. Louis to (2) Kansas City to (4) Chicago, is shown below. The illustration shows that regardless of the city of origin, any other city can be reached next, making this situation analagous to the 4-digit problem.



Very often, the number of ways to do something or the likelihood of an event occurring is important information for solving a problem, not only in mathematics, but also in other situations. It is a skill that can and should be taught as one of many problem solving strategies.

Time Management. Time management can influence problem solving. Poor scheduling can lead to insufficient time to work through a problem to a solution, or perhaps to never even getting to the problem. Problems can be solved only by taking time to solve them. An appropriate amount of time must be allocated for reflecting on the problem, for considering different ways to approach a solution, and for reviewing and critiqueing the steps used. The pressure that can result from poor scheduling can cause subpar problem solving by limiting the amount of planning time and the time needed for patient

BEST COPY AVAILABLE

deliberation. A student's patience and perserverance is often a key to good problem solving. A necessary condition for this is good time management skills.

We have recommended to students that they keep a chart of their activities to use as a basis for managing their time better. Time priorities often have to be set each day and a chart or list can help. Some students do not manage their time well enough to acquire an essential piece of knowledge, get to the library, or talk to someone who can help them. Allocating specific blocks of time to specific tasks according to their importance and the time they require is a useful skill. Systematic reflection on one's use of time and on how much is lost if it is used inefficiently can lead students to modify their own behavior.

Time management requires scheduling, but flexibility in following a schedule is also important. For example, there is a problem solving strategy which is useful when one has come to a dead end or exhausted all ideas for approaching a problem. Wickelgren (1974) calls the strategy "incubation" and it means simply to get away from the problem for a while. It is a common experience to "sleep on a problem" and to solve it with a new insight the next day. Even when time is limited, as in taking an exam, going on to other problems and then coming back can be useful. Teachers can model this strategy from time to time by leaving problems with students instead of rushing to solve them before the bell rings.

The key to time management, then, is to recognize the need for time to gather information, to try different ideas, to critique solutions, and also to have the flexibility in one's schedule for some incubation time.

Wickelgren, W. A. (1974). How to solve problems. San Francisco: W. H. Freeman.

36

The Five Step Model Extended for Problem Solving

The Five Step Model has been developed as an aide for students in solving problems. It is extended here to show how many useful strategies can be embedded within the model.

Extended Model

1. Understand the problem
   - What are the essential data?
   - Is there enough information to solve the problem?
   - Would a figure or sketch help? Maybe introduce symbols or other variables.
   - Separate the problem into manageable parts, if needed. Write down each part.
   - Can the problem be restated in a different way to help understand it?
2. Brainstorm for Possible Solution Strategies
   - Generate a lot of ideas. Don't judge them, just write them down.
   - Has a problem like it been solved before?
   - Would working a related problem be useful?
   - If there were some particular additional information, could the problem be solved? Where would the information be obtained?
3. Choose a Tentative Solution Strategy
   - Remember, the strategy may not work and the process may have to be started over.
   - For "people" problems, consequences associated with carrying out tentative strategies must be carefully weighed.
   - Also, if people are working out an interpersonal problem, then the tentative strategy will likely be a compromise. No one is likely to get everything they want.

4. Carry Out the Tentative Solution Strategy

- Check each step as the plan is carried out. Check that each step is OK. Is each step correct or valid?
- Are there probably places for errors, mistakes, or faulty reasoning? Where are they?
- Would it be useful to have someone else go over your steps?
- For implementing solutions to "people" problems, decide "Who does What, When." Maybe write it down.

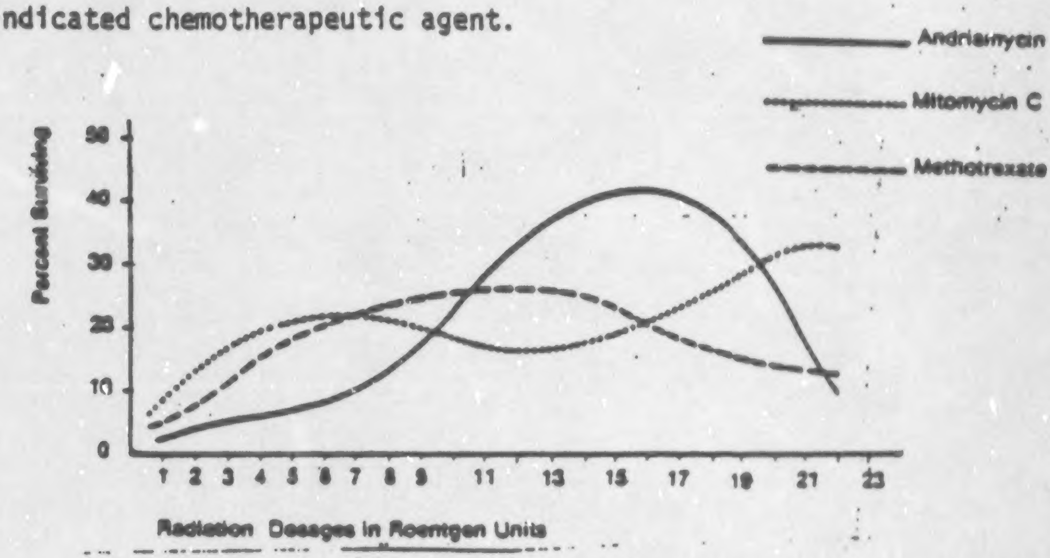
5. Learn

- Check the result if possible. Is the judgment sound? Does it have a reasonable chance of solving the problem?
- What are the implications or consequences of the solution?
- Could the problem be worked another way? Perhaps look at other people's solutions and hear what they have to say.
- If appropriate, evaluate the effectiveness of the solution.
- Have enough problems like this one been worked to begin to generalize to a plan for solving similar problems?
- Does this solved problem open up new relationships that hadn't been thought of before? Think about it!
- What are your strengths as a problem solver? Your weaknesses?
- Are you getting involved in solving problems? Are you doing the work or is someone else? Your involvement is essential.

Problems follow that students have solved using the extended model.

EXAMPLE 1. One useful strategy for this problem is to break it into two parts: The two parts are separated by "AND". The problem, as it is given to students, does not have this clue. An additional strategy some students have used is to use colored pens to color code appropriate parts of the graph so that they have visual cueing of what is being asked for in the problem.

PROBLEM. The graph below shows the percentage of lung cancer patients surviving longer than five years after receiving six weeks of radiation therapy in indicated dosage along with indicated chemotherapeutic agent.



What is the dosage for which Adriamycin has a higher five-year survival percentage than does Mitomycin C AND a lower five-year survival percentage than does Methotrexate?

EXAMPLE 2. For this next problem, many students use a sketch to help solve it.

PROBLEM. Two athletes race around an oval track 440 yards long. One races at ten yards per second and the other at eight yards per second. How much time is required for the faster person to gain one lap?

EXAMPLE 3. This problem illustrates how useful a drawing or sketch can be for keeping track of progress through a problem. It also illustrates how introducing symbols or notation (Pup X, Pup Y) can be a worthwhile strategy. The drawing under the problem was used by one of our students.

PROBLEM. Peter owned a St. Bernard and two pups. He bought 100 pounds of dog food. The mother ate ten pounds per day and each pup ate two pounds per day. After three days one pup was sold and after seven days the other was sold. How long did the dog food last?

Day	1	2	3	4	5	6	7	8
Mother	10	10	10	10	10	10	10	10
Pup X	2	2	2	2	2	2	2	
Pup Y	2	2	2					
Cumulative Total:	14	28	42	54	66	78	90	100

Answer: 8 days

EXAMPLE 4. Some students have difficulty solving this next problem until they work an easier problem like it. A video tape we have of students "talking aloud" to help solve problems has this on it from one student: "Well, let's see---if I drove to St. Louis and back in ten hours, I would just divide the total distance by ten to see how fast I went. So, for this probl one way is 300, round trip is 600, total time is 12 hours--so the answer is 600 divided by 12. Right?"

PROBLEM. If a car travels five hours at 60 mph and returns over the same path in seven hours, find the average speed.

EXAMPLE 5. Recently we had a student who couldn't find what part 1/2 is of 5/6. STUDENT: I can't do this problem! TEACHER: Do you know what part seven is of nine? STUDENT: Sure, seven-ninths, seven divided by nine. TEACHER: Can you do the original problem now? STUDENT: I've got it, 1/2 divided by 5/6. TEACHER: Yes, good for you!

BEST COPY AVAILABLE

EXAMPLE 6. The following problem requires very careful reading and understanding of the data given in the table. Nothing can be omitted or just skimmed over. Also, there is some superfluous information (where?). The problem statement itself takes a skilled reader to not make a mistake or a misinterpretation. It is also useful to analyze this problem in two parts, (Hospital B and Hospital C).

PROBLEM. The table gives the duration of stays by patients in Midvalle's Memorial Hospitals.

Hospital	No. of Entering Patients Staying Longer Than 5 Days	% of Entering Patients Staying Longer than 5 Days	% of Entering Patients Staying Longer than 1 Week
A	53	14	10
B	42	17	8
C	60	20	12
D	75	25	14
E	80	33	20

It is true that the percentage of patients staying longer than five days at Hospital C who stay longer than one week is greater than the percentage of patients staying longer than five days at Hospital B who stay longer than one week? (Answer: Compare 8/17 and 12/20.)

EXAMPLE 7. This final problem combines two very useful strategies for solving problems: trial and error, and a systematic way of listing all possibilities.

PROBLEM. Used kickballs cost $2.00, volleyballs cost $4.00, and basketballs cost $5.00. A combination of six balls where there must be at least one of each kind could not cost which one of the following? Show a combination of ball for each of the other three costs.

A. $18.00 C. $23.00
B. $25.00 D. $26.00

Higher Order Problem Solving Skills

Since its inception in 1969, the National Assessment of Educational Progress (NAEP) has surveyed the knowledge, skills, and attitudes of over one million students. The Education Commission of States, which collects this data, reported that "today's minimum skills are demonstrated successfully by a majority of students. Higher order skills, however, are achieved only by a minority of 17-year-olds, and this proportion declined over the last decade. If this trend continues, as many as two million students may graduate in 1990 without the skills necessary for employment in tomorrow's marketplace" (Education Commission of the States, 1982, p. 2). They further noted that:

> The "basics" of tomorrow are the skills considered to be of a higher level today. These skills include:
>
> - Evaluation and analysis skills
> - Critical thinking
> - Problem-solving strategies (including mathematical problem-solving)
> - Organization and reference skills
> - Synthesis
> - Application
> - Creativity
> - Decision-making given incomplete information
> - Communication skills through a variety of modes (p. 6)

A survey of 123 school systems (Henry & Raymond, 1982) found that the basic skill of "reasoning" had the smallest percentage of school systems evaluating students as having superior preparation. Sixteen percent of the schools acknowledged that "the majority of work force-bound students were inadequately prepared to reason through complex problems and decisions" (p. 21)

Education Commission of the States (1982). The Information Society: Are High School Graduates Ready? Denver, Colorado: Education Commission of the States.

Henry, J. F. & Raymond, S. U. (1982). Basic Skills in the U. S. Work Force. New York: Center for Public Resources.

Archie E. Lapointe (1984) Executive Director of the Center for the Assessment of Education Progress, drew the following conclusion from NAEP findings.

> Closer examination of the data reveals that poorly developed problem solving skills hinder students' performance in mathematics. Indeed, weaknesses exist in the so-called higher-order skills in general. Most students do well with literal comprehension but lack the skills of inference, analysis, and interpretation. Today's definition of functional literacy calls for these higher-order skills more than ever before, even as students' mastery of them is seemingly on the decline. Clearly, a renewed focus on these skills is needed (p. 666).

As students attempt to solve more and more complex problems, the need for them to acquire higher-order problem solving skills increases. For General Motors, some of these skills are problem analysis, decision-making, and planning. Some higher-order skills listed by Piaget are hypothetical thinking, observing and discovering patterns, establishing relationships, making generalizations, and sophistication with combinatorial and probabilistic thinking. Bloom's (1956) hierarchy of cognitive skills begins with knowledge of facts and extends to higher-order skills.

Level 1: Knowledge. The ability to recall specific facts, methods, or procedures: terminology, facts, rules, trends, classification schemes, criteria, methodology, principles,

---

Lapointe, A. E. (1984). The good news about American education. *The Kappan*, 65 (10), 663-667.

Bloom, B. S., Engelhart, M. D. Furst, E. J. Hill, W. H. & Krathwohl, D.R. (1956). *Taxonomy of Educational Objectives: Handbook I, Cognitive* generalizations, theories, structures. This level involves little more than retrieving stored information.

Level 2: Comprehension. The ability to make use of what is being communicated: to translate or put information in another form (restate an idea, interpret a diagram, summarize, draw a picture); to interpret or reorder ideas and comprehend interrelationships; to extrapolate or go beyond the given data (drawing conclusions, theorizing, predicting). This level involves understanding ideas.

Level 3: Application. The ability to apply knowledge and principles to actual situations: generalizing to another situation. This level involves putting into action knowledge which from Level 2 has been understood.

Level 4: Analysis. The ability to classify or break material down into its components, to understand the relationships between the components, and to recognize the principle that organizes the structure or the system: to compare and contrast, to distinguish between fact and opinion, to recognize extraneous information, to recognize unstated assumptions, to compare theories. This level involves a kind of logical thinking similar to Piaget's formal operations.

Level 5: Synthesis. The ability to bring together ideas and knowledge from many sources to form new ideas, methods, or procedures: unique communication, a plan, a set of operations, a strategy. This level involves creative or original thinking.

Level 6: Evaluation. The ability to make quantitative and qualitative judgments: to weigh, to examine, to analyze, to use criteria, to recognize the best of several reasonably good answers or solutions. This level requires the abilities of the first five levels and is crucial for substantive problem solving.

Although Bloom et. al. prepared their widely accepted taxonomy in 1956 as a guide for developing and evaluating educational objectives, actual classroom instruction has generally focused on Level 1 and Level 2 objectives. Bloom (1984) observed:

> . . . teachers in the United States typically make use of textbooks that rarely pose real problems. These textbooks emphasize specific content to be remembered and give students little opportunity to discover underlying concepts and principles and even less opportunity to attack real problems in the environments in which they live. The teacher-made tests (and standardized tests) are largely tests of remembered information. After the sale of over one million copies of The Taxonomy of Educational Objectives--Cognitive Domain (1956) and over a quarter of a century of the use of this domain in preservice and in-service teacher training, it is estimated that over 90% of test questions that U. S. public school students are now expected to answer deal with little more than information. Our instructional material, our classroom teaching methods, and our testing methods rarely rise above the lowest category of the Taxonomy--knowledge (p. 13).

Bloom, B. S. (1984). The 2 sigma problem: The search for methods of group instruction as one-to-one tutoring. Educational Researcher, 13 (6), 4-16.

Bloom was able to cite examples of successful attempts to teach higher-order skills and he emphasized the importance of such skills for problem solving and coping with change.

> Although there is much of rote learning in schools through the world, in some of the national curriculum centers (e.g., Israel, Malaysia, South Korea) I find great emphasis on problem solving, application or principles, analytical skills, and creativity. Such higher mental processes are emphasized because these centers believe that they enable the student to relate his or her learning to the many problems he or she encounters in day-to-day living. These abilities are also stressed because they are retained and used long after the individual has forgotten the detailed specifics of the subject matter taught in the schools. These abilities are regarded as one set of essential characteristics needed to continue learning and to cope with a rapidly changing world (p. 13).

There is no better context within which to develop higher-order skills than in the context of problem solving. A bonus is that the cognitive levels of knowledge and understanding can also be developed via problem solving. The National Council of Teachers of Mathematics in its Agenda for Action--Recommendations for the 80's (1980) had as its number one recommendation that mathematical content for K-12 be taught primarily in a problem-solving context.

National Council of Teachers of Mathematics (1980). Agenda for action. Reston, Virginia: National Council of Teachers of Mathematics.

Below, we will illustrate the need for higher-order problem solving skills for complex problems by relating an adult problem-solving session in which a problem from the General Motors manual was attacked.

THE PROBLEM: Your company has just obtained a one-year contract for delivering six truck loads of hazardous materials a month. All six trucks are enroute, and this is the first time any one of you has driven this busy road. All trucks are identical though they are loaded differently. You will make 11 more deliveries this year.

The second truck is immediately behind the first truck, which is pulling a forklift. Four other trucks are about 15 minutes behind on the same road. The first truck went under a cement underpass with no problem, but the second truck got stuck. Comparing the shipping documents you realize the first truck is carrying 400 containers weighing 50 pounds each. The second truck carries 300 larger containers that only weigh 40 pounds each. The cargo is on pallets. There is an open truck service station ahead. It has a fully equipped wrecker for servicing trucks on the highway. All the trucks must arrive at the destination 20 miles ahead within one hour or your company will have to pay penalties. There is an alternate route behind you but it is 10 miles longer with equally heavy traffic. You are members of the crew driving the stuck truck. What will you do?

The problem-solving group first agreed on a statement of their problem: How to get unstuck and arrive at the destination on time without hurting anyone. Then they looked for the cause of the problem. They assumed that they had checked for causes such as something wedged on top of the truck or mechanical failure and had found none. The problem was needing only about an inch more clearance since the truck did not collide with the underpass, but got stuck under it. They agreed that, since all trucks were identical, the lighter load of the second truck (12,000 pounds) as compared to the first truck (20,000 pounds) was the cause. The first truck had more clearance. Then they examined the resources at hand: the forklift on the first truck, a C. B. radio, $50 petty cash, the usual truck equipment (truck jack, tire tool, flares, reflectors, etc.), and the highway-class truck wrecker at the truck service station ahead. (THE GROUP WAS USING THE SKILL OF ANALYSIS IN CLARIFYING AND UNDERSTANDING THE PROBLEM.)

The group decided it was ready to brainstorm for solutions. They agreed that everyone would contribute and no ideas would be criticized or discussed during the brainstorming. The following list of possible solutions was generated.

1. Call the first truck on the C. B. Get Highway Patrol help to position the first truck behind the second truck and, using the forklift, transfer some of the load from truck 1 to truck 2.
2. Call the first truck on the C. B. The first truck would stop at the truck service station, transfer the forklift to the truck wrecker, send it back to wait for truck 3 and load some of its cargo on truck 2.
3. Let enough air out of the tires of truck 2 to lower it one inch.

(HERE, THE GROUP WAS USING THE SKILL OF SYNTHESIS, BRINGING KNOWLEDGE TOGETHER TO ORIGINATE A STRATEGY OR PLAN.)

The group felt that it was ready to analyze the possible solution strategies. During this time, they frequently reminded each other of the problem statement and they also considered expense to the company for the immediate solution, the risk of losing the contract or paying a penalty, and the safety factor for the truck's crew. They rejected solution 1 because of the traffic hazards and the possibility that truck 1 would then not make it through with less weight. Even though solution 2 would involve hiring the wrecker, it was a solution they could count on, and paying a penalty or losing the contract was financially very bad for the company. The traffic hazards still bothered them. Solution 3 was their preference for the simplicity and the time factor, but it had to be tried to see if enough air could be let out of the tires to lower the truck one inch. They finally came up with a plan which incorporated ideas 2 and 3:

1. Call ahead to truck 1, informing them of the problem and that truck 2 would attempt the solution of letting air out of the tires. Tell truck 1 to stop at the service station ahead and prepare to transfer the forklift to the wrecker.
2. Attempt to get unstuck by letting air out of the tires. If it works, inform truck 1 and call the other four trucks giving them full information about the problem they might face, the load weights involved, and the solution for truck 2. Check the possibility that the alternate route might be feasible for them.
3. If deflating the tires doesn't work, call the service station and the Highway Patrol and arrange to load some cargo from truck 3 to truck 2 by forklift. Have the wrecker stand by at the underpass for possible problems with the other trucks.

Once the immediate strategy was determined, the group turned its attention to the long-range problem of the remaining 11 deliveries. They recommended to the company that loads be computed or the height of skill they most wanted in their workers. One of the conclusions from a survey of 593 secondary vocational training teachers in 32 vocational training program areas (Greenan, 1983) was that "all interpersonal relations skills are very important for success and highly generalizable across all program areas and programs (p. 57)."

Considering the importance placed on interpersonal skills by representatives of business and industry and by vocational educators, they should be part of a pretechnical curriculum. This section of the paper describes specific interpersonal skills which can be learned and guidelines for group problem solving, including an extension of the Five Step Model which incorporates the specific interpersonal skills described below.

SKILL: Awareness of Self and Others

Verbal communication skills can be learned, but a person may be regarded as insincere or robot-like if the skills are thought of as tools to "use" on other people. A very important part of instruction in interpersonal communication is awareness of personal needs and values and also the needs and values of others. Only then will new behaviors become comfortable and natural habits of communication. The important changes are in how one views oneself and others. The verbal skills will follow with practice.

Values. Some experts believe that most values are acquired by the time a person is about ten years old. Young people are influenced by parents, peers, teachers, and "heroes". Their values reflect what they have learned about right and wrong, good and bad, from interactions with people and lessons from other parts of their environment. Morris Massey presented this point of view in The People Puzzle (1979). He explained that although significant emotional events can produce a change in values, people generally maintain those early values throughout their lives. So if one

BEST COPY AVAILABLE

Greenan, J. P. (1983). Identification of Generalizable Skills in Secondary looks at a cross-section of the population, different values legitimately exist. Consider, for example, values differences between those people who were ten years old during World War I and those who were ten years old during Watergate. Massey gave an example of a factory foreman who realized that working overtime was a penalty for his younger workers, but a reward for his older workers. In getting along with other people, it is important to accept that their values are different rather than to label them as wrong. In problem solving situations, solution strategies which conflict with people's basic values will probably not be effective. For example, people who value their health more than their financial status will not be highly motivated by higher pay to be more productive if unhealthy working conditions exist.

Needs. Most dissatisfactions with people and with situations are the result of one's needs not being met. Some basic needs are security, belongingness, love, and aesthetic fulfillment. But each person has a unique set of needs which might include, for example, a need to feel important, a need to dominate others, a need to be a follower, a need to have one's way, a need to have others in one's debt, etc. Sometimes people find it difficult to put their finger on what is bothering them about a situation. It they could identify which of their needs are not being met, they would be more likely to be able to find reasonable solutions. One very important need for most people is to feel adequate, and when their adequacy is threatened, they tend to behave irrationally. Sensitivity to one's needs and the needs of others is an interpersonal skill of great importance.

Feelings. Awareness of one's own feelings and sensitivity to the feelings of others is absolutely necessary before knowing how to respond to another person effectively; that is, so that communication does not damage the relationship. In general, feelings fall into four categories: Mad, Glad,

BEST COPY AVAILABLE

Massey, M. (1979). The People Puzzle. Reston, Va.: Reston Publishing.

Sad, and Afraid. Activities exist for helping people to recognize a range of feelings within each category. A simple example of an activity is to simply list as many feelings as possible. In order of decreasing intensity, some feelings under Afraid are: panic-striken, terrified, frightened, threatened, alarmed, worried, anxious, bewildered, uneasy, confused, unsure. As will be explained in later sections, sensitivity to feelings is necessary both for effective listening and for being assertive.

SKILL: Recognizing Problem Ownership

Good interpersonal skills are useful in most situations where two or more people interact--at home, at work, or in social or recreational settings. They are particularly important, however, when someone is upset. It is difficult to function efficiently with feelings of sadness, frustration, helplessness, etc. If one wants to facilitate communication at such times rather than block communication, it is necessary to recognize which person is having negative or uncomfortable feelings--oneself or the other person. The question, according to Thomas Gordon (1974) is, "Who owns the problem?" The answer to that question determines which interpersonal skills are the most useful for effective communication. When the other person is upset, listening skills are important. When you are upset, the skills to be aware of are assertive statements and self-disclosure statements. These skills are described in later sections. Here are some examples of problem ownership:

> Suppose a teacher or a manager or a supervisor perceives any of the following from a student or a worker:
>
> - discouraged about personal progress
> - failing to meet a performance standard
> - depressed about a death in the family

- not being accepted by peers
- having a conflict with a peer
- not being able to compete with more talented peers

It is the student or the worker who "owns" the problem. The negative or uncomfortable feelings belong to the other person, and good listening skills are needed.

On the other hand, suppose a teacher or a manager or a supervisor is faced with any of the following from a student or a worker:

- not completing work
- borrowing something and not returning it
- being habitually late
- not following instructions
- being destructive with equipment
- concealing information
- refusing to cooperate
- ignoring important procedures

In cases like these, very likely the teacher (manager, supervisor) will feel upset and will recognize that he or she "owns" the problem. Skillful assertive statements will be useful here.

SKILL: Avoiding Roadblocks to Communication

Certain kinds of responses are not facilitative when another person is upset or angry. Thomas Gordon (1974) called them "roadblocks". Some of them might be all right when no one "owns a problem", but when someone is upset in any way these responses may block communication. They can convey lack of interest, not wanting to listen, or not understanding what the person is saying and feeling. Roadblocks can convey many negative messages: the person is not a competent problem-solver, the person needs to be led, or the person just is not very bright. These messages can be damaging to a person's self-esteem and to relationships between people. The skill is to understand how roadblocks inhibit communication and to cease using them.

Roadblocks to Communication

Directive Responses. These carry a hidden message that the other person's feelings or point of view are not being considered--that there is no interest in listening and the situation is to be disposed of in the quickest and easiest way: by *telling* the other person what to do.

1. *Ordering, commanding, directing*

   "Stop complaining about the system and concentrate on doing the best work you can."

   "Don't keep making excuses. Just get the job done."

2. *Warning, threatening*

   "If this situation doesn't improve, I'll have to settle it for you and you won't like my solution."

   "If you don't start reading the assignments, I'll give a quiz at the beginning of every class."

Solution Responses. These are attempts to solve other people's problems for them. So what's wrong with giving advice? First of all, a person who is *upset* most likely will not even hear the advice. Second, advice is generally given from one's own perception of the other person's needs and that might not be the same as the other person's perception. Roadblocks usually address other people's apparent problems rather than their real problems. By jumping in with advice, the focus of the conversation is taken away from the person with the problem. Advice is O.K. if requested or when the other person is no longer experiencing upset feelings.

BEST COPY AVAILABLE

3. *Advising, offering solutions or suggestions*

   "Why don't you give up the weekend job and spend more time with your family?"

"All you need is more confidence in yourself. Tell yourself you can really do it."

Persuasive Responses. Persuasive responses are attempts to persuade other people to change their feelings, thoughts, or behaviors. Guilt, shame, and intimidation are sometimes the hidden persuaders. A person who is upset wants to have their feelings understood, not denied.

4. Moralizing, preaching, giving "shoulds and oughts"

"You souldn't feel guilty about turning someone in. You have a responsibility to the whole group."

"If you didn't vote, you wouldn't complain about the outcome."

5. Teaching, lecturing, giving logical arguments

"It's very unlikely that your son is in trouble. Most runaways don't go very far, and they usually come home when their money runs out."

"If I gave you an extension, then I'd have to give other people an extension also."

6. Reassuring, synpathizing, consoling, supporting

"Oh, it's not all that bad. Everything will look better in the morning."

"Sure, you can do it. You always come through in a crunch."

Evaluative Responses. These responses involve a negative or a positive judgment. The other person's actions are evaluated rather than objectively observed. Evaluation can be a legitimate function of a supervisor, a teacher, or a peer in a "problem-free" situation, but it is not effective when someone is experiencing unpleasant or uncomfortable feelings or is really down.

7. Judging, criticizing, disagreeing, blaming

"You just aren't putting any effort into your work."

"If you'd plan ahead, you wouldn't have all this to do at the last minute."

8. Name-calling, stereotyping, labeling, ridiculing

"All right, Mr. Know-It-All."

"That's the way losers talk."

9. Praising, agreeing, giving positive evaluations

"With as much common sense as you have, I'm sure you're going to handle this perfectly."

"You wouldn't intentionally do anything to hurt anyone's feelings. You're the kindest person I know."

10. Interpreting, analyzing, diagnosing

"You may think you don't want that job, but I think you really do. You're just afraid that you'll be turned down and you don't want to rush into it."

"You're just acting that way to get attention."

Avoidance Responses. These responses are designed to avoid communication about the other person's problems. They convey disinterest or unwillingness to carefully listen.

11. Withdrawing, distracting, being sarcastic, humoring, diverting

"Let's talk about something more pleasant."

"You're making a mountain out of a molehill."

"Come on, let's see a smile."

"You think you've got problems? Let me tell you about what happened to me today."

12. Emphasizing your own needs

"Just think about the position that puts me in."

"I can't do anything about that. I set that deadline three weeks ago so this wouldn't happen."

"That's all I need right now is to start getting a lot of flack from you."

Questioning Responses. Questioning is a very common response. The impulse to ask questions is so ingrained in adults that they are seldom even consciously aware of the purpose of their questions. It is important to be aware of the negative effects questions can have on someone who is experiencing a problem. A good analysis of types of questions, their purposes, and their effects appears in Wittmer and Myrick (1974), Facilitative Teaching: Theory and Practice.

13. Questioning, probing, interrogating, cross-examining

"What made you think you could get away with it?"

"Why are you getting upset?"

"Do you still put everything off until the last minute?"

Interrupting. Interrupting is a major non-listening response and a very common one.

14. Interrupting, interjecting, rushing

"But, don't you see . . ."

"Yes, but . . ."

(Nonverbally shaking head "no" while other person is talking)

SKILL: Listening

When one has identified the other person as "owning the problem", good listening skills are needed. Very few adults have any training in listening skills and they are perhaps the most important skills in interpersonal relations. The first step is to be sincerely committed to hearing what the other person is saying and feeling. There should be a concentrated effort to focus on the other person's thoughts and feelings and not to inject one's own agenda into the interchange. There are many increasingly skillful listening responses one can give, and each step up makes the other person feel more that they are being not only listened to but also understood.

1. Encouraging the Other Person to Talk

Silence. This first step is indeed a skill requiring practice. It requires committing oneself to focus on nothing else but the other person. It is a skill seldom practiced at social events where most people's minds are usually on what they are going to say next and where a lot of interrupting and "posturing" occurs. Communication is usually enhanced by allowing people time to collect their thoughts or perhaps to gather courage to express their thoughts and feelings.

Nonverbal Encouragement. Your body can convey that you are interested in listening. Eye contact conveys that you are being attentive. Turning to fully face the other person is a message that you are giving your full attention. If you were reading or writing, you can close your book or put your pencil down. Be aware of the physical environment. Move out from behind your desk or position yourself so that there is no physical barrier between yourself and the other person. Nodding your head at times can mean "Yes, go on, I'm listening." A side-to-side movement can mean, "I'm sorry to hear that" or "That's too bad."

Verbal Encouragement. Very simple statements can encourage a person to talk. "I see," "uh-huh," "oh, no!," "wow!" Sometimes more direct encouragement is called for, particularly if the other person is silent for a long time. "Would you like to talk about it?," "Go on," "I have some time right now if you'd like to talk some more," "Do you have time to talk about it now?," "I'd like to hear more about that." "How did you feel about that?"

2. Responding by Reflecting Meaning. When the other person "owns the problem" or is upset, encouragement to keep talking is important, but there comes a time when the listener wants to say something that is helpful

---

Wittmer, J. & Myrick, R. D. (1974). Facilitative teaching: Theory and practice. Pacific Palisades, CA: Goodyear Publishing Co.

Paraphrasing. One very effective listening response is simply to reflect back what was said. This leaves the ball with the speaker and gives evidence that listening occurred. It also gives the other person a chance to "hear" what he or she has been saying. It would sound awkward to simply repeat or "parrot" the other person's words, so try to paraphrase so that it sounds natural.

- Other person: I can't stand the way Jones keeps pacing up and down.
  - Parroting: You can't stand the way Jones keeps pacing up and down!
  - Paraphrasing: Jones' pacing really bothers you!
- Other person: I just don't know how to keep those two people from monopolizing the meeting.
  - Parroting: You don't know how to keep those two from monopolizing the meeting.
  - Paraphrasing: Getting everyone involved is tough when those two talk all the time.

Clarifying, Confirming. Sometimes it is difficult to understand what a person is saying because some crucial information is missing. It can be helpful to ask for more information to clarify what has been said or to confirm that it has been understood.

> "If I understand you correctly, you tried to explain your actions, but she wouldn't let you. Then it was after that that you wrote the letter."
>
> "When did all this take place?"

Questions should not be probing and "why" questions should be avoided. For example, "Why do you think he was angry at you?: might be a roadblock to communication. Roadblocks must not be used.

3. Responding by Reflecting Meaning and Feelings. The term "Active Listening" is widely used for the kind of listening which reflects not only meaning but also feelings. Listening for feelings is the key to being empathic.

Almost everything a person says is preceded by and is the result of some internal thought or feeling they have. Those thoughts and feelings are encoded into verbal messages and what people say usually is not an exact translation of what they are thinking or feeling. Even a message that sounds very direct like, "You're standing on my foot," really means, "Move! Get off my foot!" Most social beings have some skill with deciding the meaning of verbal messages. It is a rare person who would take literally the question, "How many times have I told you not to slam the door?" The meaning and the feelings are clear: "I'm irritated because you slammed the door!" Through awareness and practice the skill of Active Listening can become a natural and highly facilitative communication tool. Notice how feelings, as well as meanings, are reflected in the following example of an adult educator's Active Listening skills.

Student: (angrily) Well, here's my project. I hope you like it because it took a lot of work, but I only did it because it was required!

Teacher: The project was a waste of time for you. (REFLECTING MEANING)

Student: Real busy work! I have better things to do with my time!

Teacher: You really resent the time you spent on this. (REFLECTING FEELINGS--resentment)

Student: Yes! (pause) Well, it *was* interesting and I *did* learn some things. It's just that I can't do this kind of thing in my classroom. My kids would go wild at first and the principal would have a fit.

Teacher: You wouldn't mind trying it but you're a little afraid of what might happen. (REFLECTING FEELINGS--fear or apprehension)

Student: You bet! In *my* school, it's a real risk just to put the desks in a circle! Sometimes I wonder why I even bother to take classes and learn new ideas.

Teacher: I guess it can be really frustrating at times. (REFLECTING FEELINGS--frustration)

In this example, the student was angry and the teacher could have "bought into" the student's problem and responded defensively with a Roadblock like, "Well, if you remember, I told the class to see me individually if anyone had problems with the assignment. You should have done that." Then the conflict could have escalated. Or, the teacher could have dismissed the student's feelings with, "Well, I'm sure it's a very good project. Sooner or later, you'll appreciate having done this." That could have ended the conversation with the student "turned off" and thinking that the teacher didn't understand and didn't care. Instead, the teacher was alert that the student had a problem. The teacher relaxed and listened to the student's anger, reflecting back meanings and feelings. Two things happened: (1) once the angry feelings were out, the student calmed down, and (2) the real prob came out--not anger at the teacher for requiring the project, but frustratio with a restrictive school system.

Active Listening serves many purposes in interpersonal communication, and it is an additional skill to be aware of one's objective when listening. Some points for awareness:

- Dealing with anger. When another person "blows up", it is particularly important for the listener not to react to the precise meaning of what was said, because the angry words most often screen the real problem. If the listener reacts defensively, the listener is focused on self-protection and is not hearing the real problem. It is more useful to encourage an angry person to keep talking than to give put-downs, to argue, or to give rebuttals. With Active Listening, angry feelings subside and are diffused. The real problem usually emerges and the screened feelings become apparent: sadness, frustration. resentment. etc. The listener might then feel a need to deliver a self-disclosure message; for example, "I do not like to be called names," but such messages are not heard or processed as long as the other person is upset.

- Facilitating problem solving. One must not expect that Active Listening will solve other people's problems for them. Rather, it helps other people to clarify problems for themselves, to assume responsibility for their feelings and actions, and eventually to find their own solutions. Active Listening is also an invaluable skill in group problem solving for clarifying and understanding the individual needs that must be considered when searching for a successful solution strategy.

- Support and rapport. Active Listening is not just for intense or explosive situations. Feelings underlie most of the verbal and nonverbal messages people send to one another, and this is particularly true in the classroom or in the workplace where pressures and fears about learning, competence, acceptability, and control exist for both teachers and students, for both managers and workers. Good listening is contagious and skilled individuals can contribute greatly to the kind of cooperative atmosphere which enhances productivity and the quality of people's personal and occupational lives.

SKILL: Assertive Statements

Listening is important when another person is upset. But when people recognize that the upset feelings belong to them--that they "own the problem" it is equally important to communicate in a nonthreatening manner. The skill is assertiveness.

Being assertive is somewhere between being aggressive and being passive. Aggressiveness involves trying to get your own needs met at the expense of someone else's needs. Passivity involves meeting other people's needs at the expense of one's own needs. Assertive statements do not put the other person down and do not blame or criticize. Compare these statements.

Aggressive: You people don't know what you're doing! This is the second time I've brought this coffeemaker back and it still doesn't work right. If you don't fix it I'm going to write to the president of the company.

Passive: I'm terribly sorry to bother you again, but this still isn't working right. Do you think you could look at it again?

Assertive: There's a problem with this coffeemaker. Repairing it doesn't seem to solve the problem, so I'd like a replacement . . . No, I don't have any more time to spend on bringing it in. I'd like a replacement, please.

I-Messages. One kind of assertive statement is called an "I-Message". Its purpose is to maximize the probability of the other person choosing to change the behavior that is interfering with one's needs. It consists of:

- An objective description of the behavior
- The tangible effect of the behavior on the speaker
- The speaker's feelings
- The preferred behavior or expectation

A substitute teacher found the following I-Message to be effective: "When there's a lot of talking in here during reading (OBJECTIVE DESCRIPTION OF BEHAVIOR), it makes it difficult for me to hear students in the reading group (TANGIBLE EFFECT), and I get frustrated (FEELINGS). It would help me a lot if you would whisper or not talk at all while you work (PREFERRED BEHAVIOR)."

The significance of the "I" in "I-Message" is that the upset person is "owning" the problem. When "you" creeps into the message, the other person tends to become defensive, because "You-Messages" usually come out as judgmental Roadblocks. I-Messages can enhance communication by clarifying the nature of the problem without attacking the other individuals involved.

Problem Solving in Groups

Problem solving in groups is now emerging as an important part of the work world for all levels of employees, not just managers (Pratzner & Russell, 1984). Many companies are involving workers in diagnosing problems and implementing effective solutions. These organizations have implemented programs called "Quality Circle Programs", of which one important element is the Quality Control Circle. Very briefly, Quality Control Circles have these things in common. Size: preferably five to ten members. Volunteerism: freedom of choice to join. Meetings: one hour weekly, with exceptions. Skills: brainstorming, cause and effect analysis, data collection, effective planning.

Japanese industrialists have been using Quality Control Circles since 1960, and Japan is now the world's leader in productivity growth. As many as 11 million workers are involved in the Quality Circle movement throughout Japan, and industries in all of the world's industrialized countries have shown interest in implementing the process. The Lockheed Company's Missile and Space Division was the first United States organization to put the concept into action in 1974 and a $500,000 investment in the program resulted in an estimated savings of $3 million (Lloyd & Rehg, 1983).

The National Center for Research in Vocational Education listed organizations in the public sector which have implemented employee participation groups (Lloyd & Rehg, 1983). Among these are the U. S. Air Force, the U. S. Army, the U. S. Navy, and the Federal Aviation Administration. Also listed were 162 organizations in the private sector. Among these are such

---

Pratzner, F. G. & Russell, J. F. (1984). Implications of quality of work-life developments for vocational education. Columbus, Ohio: The National Center for Research in Vocational Education.

Lloyd, R. F. & Rehg, V. R. (1983). Quality Circles: Applications in vocational education. Columbus, Ohio: The National Center for Research in Vocational Education.

major companies as Bendix Corporation, Firestone, G. E. Major Appliances, General Foods, General Motors, Hewlett Packard, Hughes Aircraft, J. C. Penney, McGraw-Edison, Polaroid, 3M, Union Carbide, Uniroyal, and Westinghouse.

Not only are Quality Control Circles advantageous for productivity in business and industry, they are very effective for problem solving in any organization. Lloyd and Rehg (1983) gave an example of effective use of Quality Control Circles by school districts.

> . . . a midwestern school district has used the QC process to solve problems that resulted from declining enrollments and escalating costs (Rehg, 1982). Ten quality circles made up of administrators, faculty, staff, and citizens met to develop solutions which were then compiled and distributed to the ten groups. Consensus was reached, and the proposed solution was then presented to the public for review. The school board adopted the solution essentially as proposed by the quality circles. No complaints were received nor were any grievances filed despite the facts that some teachers were reassigned and some terminated, and that some schools were closed. In contrast, the school board, in an adjoining district facing a similar problem, made a unilateral decision to close certain schools. In response, a citizen's group filed a lawsuit in an attempt to block the closing.

Pratzner and Russell (1984) have delineated the skills, knowledge, and abilities needed for high-involvement participative work settings (pp. 12-13). Under the skill area Group Problem Solving they list eight sub-categories: Interpersonal Skills, Group Process Skills, Problem-Solving Skills, Decision Making, Planning, Communication, and Thinking/Reasoning. The specific skills for two of these categories are given below.

Interpersonal Skills

- Self-directed
- Flexible
- Assertive
- Open
- Curious to learn
- Able to share/teach
- Responsible
- Understanding of behavior

Communication

- With individuals
- With groups
- Presentation skills
- Verbal skills
- Writing skills
- Listening skills

The General Motors Employee Participation Groups Member Manual (1980) is used to train employees to be effective group members. Many of the skills the employees learn are interpersonal skills. Some examples:

Involving Others. You may notice some people getting quiet during a meeting. They may have information or ideas but may be reluctant to break into the discussion. You can "invite" them in. Example: "John, we haven't heard from you yet. What do you think?"

Give Credit--Avoid "Put-Downs". If you borrow another's idea or add to it, give them credit for the basic idea. If you don't like another's idea, avoid criticizing the person. Example: "Mary's idea of using the scrap is a possibility. I like it better than not using the scrap." (Not using the scrap was Paul's idea.)

It is not sufficient for successful group problem solving for a person to be adept at problem solving strategies without also having good interpersonal skills. Unlike individual problem solving, group solution strategies are usually arrived at through processes which require listening, empathy, cooperation, and concern for everyone's needs.

The Five-Step Model is highly adaptable to group problem solving, whether mutual problems exist for only two individuals or for a group. Some problems center around a Conflict of Needs. That is, the needs of one or more persons are not being met, and a change in the behavior of the other person or persons is necessary to solve the problem. In such situations, the specific interpersonal skills described earlier are necessary, particularly at the first step, as shown below.

Five Step Model for Solving Problems Resulting from a Conflict of Needs

1. Understand the Problem
   - One person initiates the process by giving an *I-message*.
   - Often, the other persons will be defensive or will unveil their own related problems, so the first person must *reflect meaning* or *actively listen* in order for the real problem(s) to be identified. *Avoiding roadblocks* is critical at this point, particularly if the sharing becomes emotional.
   - Once the problem is clarified, it should be summarized to be certain that there is agreement on what the problem is.
2. Brainstorm for Possible Solutions
   - Suggestions are not to be evaluated, and a skillful person *encourages* others to contribute ideas.
   - *Self-knowledge* is important for resisting tendencies to interrupt, to put other people's ideas down, or not to be open to new ideas.
3. Choose a Tentative Solution
   - Although compromise is sometimes necessary at this stage, the needs of both or all people must be met as best as possible. *Assertive statements* are important if one feels that a solution is not good for all the people involved, particularly for oneself.

- *Active listening* is useful for helping others clarify their positions about possible alternatives.

4. Carry Out the Tentative Strategy
   - It is important to decide "Who, does What, When."
   - A very specific time should be set for evaluating the solution, which should be considered a trial solution, perhaps the first of several attempts to meet everyone's needs.
5. Learn
   - As new procedures, routines, or behaviors are attempted, look for opportunities to increase *self-knowledge*. If the solution is not working, this is the time to look more closely at your real needs. Perhaps the problem, as you saw it, was not the real problem for you. Maybe you need to change what you are doing. Maybe the environment needs to be changed.
   - Evaluate the effectiveness of the solution. The process might need to be repeated, from steps 1 through 5.

Thomas Gordon (1974) calls this process the "No Lose" problem solving method. In most interpersonal problem solving one person "wins" and the other "loses". Examples are: authoritarian classrooms where teachers "win" and students "lose" or permissive classrooms where students "win and teachers "lose". Analagous situations occur in business and industry when management and labor become involved in power struggles. The objective of the Five Step Model is to resolve conflicts or to solve problems so that everyone gets some of their needs met.

An example of the No Lose process was given in the diary of one of our students, a teacher who was learning new interpersonal skills and applying them in her classroom.

There has been a situation in my classroom in which students are absent for a day or several days and don't make up the math assignments they missed. Then when I average up grades at the end of the nine-week period, some students don't have all the grades they should and their grade average is lowered. I decided to discuss this situation with my students to see if we could reach an agreement on this matter. This is how the situation went:

Teacher: Class, I think we need to discuss the matter of not making up math assignments after being absent. When the assignments are not made up, I have to explain to your parents why your math grades are so low, and this is really embarrassing and annoying to me. I would prefer that you make up the assignments, but students haven't been doing so. I'd like to know how you feel about this situation.

Steven: I don't know which pages I missed. You told me what assignments I had not done, but I forgot what they were before I had finished all the assignments.

Scott: I didn't understand all of the assignments, so I didn't do do the ones I couldn't do.

Teacher: Some of the assignments you didn't do because you didn't know how to do them.

Scott: Yeah, I guess so.

Steven: I could have finished all of mine if I knew what all the assignments were. I asked some of the other students, but they didn't know.

Teacher: You didn't know what some of the assignments were, so you didn't do them.

Steven: Yes.

Sylvia: We don't have time to catch up on assignments when we've been absent. We have math work every day, and if we finish that, there's not much time left for working on other assignments.

Teacher: You're saying that lack of time is preventing you from getting all your assignments done.

Sylvia: Yes.

Veronica: We have to catch up on all our other assignments that we missed too. I just can't get it all done, especially when I've been absent two or three days.

Teacher: Veronica, you also think that there is not enough time to get your assignments done, especially when you have to also catch up on work missed in other classes.

Veronica: Yeah, but I know we have to do our math assignments in your class too.

Several other students voiced similar opinions about why math work that was missed when they were absent was not made up. After a few more minutes of students expressing their feelings and my Active Listening to them, I summarized our problem: "Well, it looks like the problem for me is people not making up assignments after being absent and my having to give lower grades because of the missing work and explaining this to your parents. You are saying that you don't always know what the assignments are, that sometimes you don't know how to do them because you missed the explanations when you were absent, and when you come back, there is a lot of work to be made up from all your different classes." I then asked for suggestions on how we could solve this problem. I wrote the suggestions that were given on the board. They were:

1. Give students a zero if they haven't got the assignment done within a week after they come back to school.

2. Make up a folder for each child and put in it any assignments that the person needs to finish. Teacher would explain any work that the child doesn't understand.
3. Send work home by another student or the absent student's brothers or sisters.
4. Let students work in class on the assignments they missed while everyone else is doing the regular assignment for the day.
5. Call their parents and tell them when students don't make up assignments so they can be expecting them to have a low math grade.

Each solution was then discussed to see why or why not it would be a good solution to our problem. Most didn't like getting a zero for not completing work. Neither did they like the idea of calling their parents about missed assignments. Many students thought that sending work home by brothers and sisters wasn't good because sometimes it was hard to find them and give them assignments and they may forget to give it to them when they got home. I didn't like the idea of students working in class on missed assignments because then they would miss the work scheduled for the day, and they would be even farther behind.

We talked about solution 2 and everyone felt it was a good one, but a time limit should be set on handing the folders back in with the assignments completed (a week was designated). So we decided to try it. Students would make their own folders, and the teacher would put missed assignments in them. A person who didn't do his assignments would have a conference with the teacher to see what the problem was. A student who lost his folder would be responsible for making a new one and finding out from the teacher which assignments needed to be completed.

Students are getting work done in their folders and getting them back so far. There has been no instance of lost folders yet. About two or three people have not been able to finish their assignments within the week limit, especially when they have been out of school for several days, but I have asked the class if it is okay to give them a time extension, and they agreed.

I really feel that students are trying to get assignments done because they know that they had a part in making this decision, and they are trying to be more responsible for turning in their work.

Similar skills are used in business and industry when Quality Control Circles engage in group problem solving. Lloyd and Rehg (1983) gave examples of the outcomes of some of these group efforts.

- A Quality Control committee suggested a procedure which was initated by the Purchasing Department at Westinghouse Electronics Systems Center in Baltimore, Maryland. By returning overshipments to vendors at their own expense, an estimated $636,000 was saved.
- Management of a General Motors plant in Tarrytown, New York was considering closing the plant down because of high absenteeism and poor product quality. The number of outstanding employee grievances against management totalled two thousand. Since Quality Circles began to hold meetings to discuss complaints and ideas for boosting efficiency, the number of outstanding grievances has dropped to thirty, and absenteeism has been reduced to 2.5 percent.
- At the Lockheed Company, a Quality Circle developed a method to mold a plastic part assembly in two instead of five steps. The redesigned assembly is lighter and stronger than its predecessor, and has resulted in an estimated savings of $160,000 over the life of the contract. Since 1974, Lockheed's savings from its

Quality Control program are estimated at almost $3 million, six times the cost of operating the program.

Interpersonal skills are also central to successful negotiation as described by Fisher and Ury in their 1983 best-seller, Getting to Yes: Negotiating Agreement Without Giving In. Negotiations occur in everyday life, as when a person returns a defective product and needs a settlement or when price differences must be resolved. In more formal negotiating processes, individuals represent constituencies and negotiating sessions are sometimes hard-hitting encounters, even to the point of using "dirty tricks". Fisher and Ury, however, advocate an approach that consists of skillful interpersonal interactions combined with assertive skills. Some of the skills they mention are awareness of one's feelings, active listening, and I-messages. ". . . human beings . . . are creatures of strong emotions who often have radically different perceptions and have difficulty communicat clearly. Emotions typically become entangled with the objective merits of the problem . . . Figuratively if not literally, the participants should come to see themselves as working side by side, attacking the problem, not each other (p. 11)."

It is clear that the American workplace is placing increasing importance on employee problem solving and that interpersonal skills are needed to be effective in problem solving groups. In addition, most citizens are involved in several groups in their daily lives--in classes they take, in PTA's, in social groups, in church groups--and the quality of their participation would be enhanced by being more skilled interpersonally. That is sufficient evidence to consider interpersonal skills "basic" and to seriously consider where and how they should be taught in the pre-college curriculum.

Fisher, R. and Ury, W. (1983). Getting to Yes: Negotiating Agreement Without Giving In. New York: Penguin Books.

There is a need for a formal curriculum for problem solving skills. Skills must be studied, analyzed, and practiced. At the same time, teachers should acquire these skills themselves so that they will be effective models for students. Active involvement in actual problem solving is invaluable, and this should occur at all grade levels. Here are some examples from our observations.

We observed a high school biology class in which the problem of too much noise during lab periods was solved by the students in such a way that they monitored themselves and increased their productivity.

We observed the faculty advisor for a high school yearbook use the Five Step Method with a Cooperative Education student who was habitually late to yearbook meetings because of a part-time job. Their mutual solution was to have another student fill the student in with information that was missed because of being late and which was needed to do his job.

We observed a fourth grade teacher facilitating a rule-setting session during the first week of school. Class rules were determined to satisfy students and the teacher, and consequences were agreed upon.

We observed a first grade teacher deal with two students who were disputing the ownership of a red felt pen. She directed the students to go out in the hall, settle the matter, and report their solution to her. They did.

We observed a first-grade teacher patiently sitting by a child who was learning to put the papers from his messy desk in order. The child was learning to make decisions and to be responsible. The teacher said nothing except to occasionally ask, "Does that paper go home or will you throw it out?" The child made the decisions.

Teachers must be prepared to facilitate problem solving whenever the need arises. These are the learning experiences which students will remember above all others.

Business' Perspective of Basic Skills

Denis A. Junge
M. Harry Daniels
Joseph S. Karmos

Southern Illinois University
Carbondale, Illinois

Running head: Business' Basic Skills

BUSINESS' PERCEPTION OF BASIC SKILLS

Now more than at any other time the nation needs supportive cooperation between education and business. Workers with academic deficiencies cost business millions of dollars each year in errors and in communication breakdowns. The implications of inadequate preparation in basic skills for business and industry are measured in decreased productivity and in dollars spent for remedial training. Clifton Bardsley, personnel manager for McDonnell-Douglas Corporation, stated at the 1982 American Vocational Association's Conference (cited in Foster, 1982) that "Without a solid education program, the problem of productivity cannot be solved," (p.6). The report American Education: An Economical Issue, noted that 35 percent of the companies surveyed provided remedial training for their employees (Hemmings, 1982). For example, AT&T reported spending six million dollars a year to train 14,000 employees in basic reading and mathematics. The Center for Public Resources (CPR) reported that a majority of companies they studied indicated that high school graduates were seriously deficient in basic skills (CPR, 1982). The implication for education is clear: Education must improve its ability to provide the basics of education or risk being replaced by businesses doing their own training and education.

There is little doubt that business and industry will expect education to provide companies with entry level personnel that possess the skills that will enable them to contribute to corporate goals. An objective of our project was to facilitate communication and collaboration between the business community and the educational system by assessing, clarifying, and articulating those skills that will enhance individual adaptability as well as industrial growth. A study was designed to survey the perceptions of business and industry in the state of Illinois on the importance of specific basic skills for successful employment, and to compare these views to business and industry's perceptions of actual employee competence of entry level employees with a secondary education.

METHOD

Instrument

The Basic Skills Questionnaire that was developed was based on a questionnaire used by the Center for Public Resources for a similar task. The questionnaire consisted of thirty items divided into six basic skill catagories: mathematics, writing, reading, speaking and listening, reasoning, and scientific knowledge. Each item represented a specific competency associated with one of the skill categories. For example, some items assessing competencies within the mathematical category were: "Perform the computations of addition, subtraction, multiplication, and division using whole numbers, fractions, and decimals"; and "Make and use measurements in standard units." Open-ended items were used in the questionnaire for other important skills not specifically listed.

The questionnaire was designed to survey personnel directors' opinions of entry level employees with a high school diploma. The directors were instructed to indicate on a Likert-type scale the relative importance of the various basic skills for individuals to successfully perform their jobs. Respondents were also requested to report their perceptions of the degree of actual competence possessed by entry level personnel on each of the skills. The scale contained five degrees (from low, moderate, to high) representing ascending levels of importance and levels of competence.

Procedure

A letter of introduction was constructed to convey information about the project. The letter described the background of the project, explained the purpose of the questionnaire, estimated the amount of response time, and emphasized the importance of responding. Special emphasis was given to the need for collaboration between business and education and the value of the respondent's feedback. The letter was submitted in a package which also included the questionnaire and a self-addressed stamped return envelope.

The package was mailed to personnel directors of 116 of the largest companies (according to Fortune 500 and Forbes 798) which had a corporate office in Illinois. Large corporations were used to obtain opinions about large numbers of employees and a broad range of job descriptions. The companies sampled specialized in finance, manufacturing/mining, service, utilities, or insurance.

Fifty-one responses were returned, yielding a response rate of 44%. This was close to the average rate of 48.1% found by Borg and Gall (1983) in a review of initial response rates for experimental studies. Because of the competitive nature of business many companies are reluctant to release "in-house" information, and this may have been a factor in the response rate of our study. However the rate compared very favorably to the one of 9% of companies which gave detailed information to the CPR survey (1982). This difference in response rate might be attributed to an improvement in the efficiency of responding to our questionnaire; a respondent only had to circle a perceived degree, whereas the CPR requested written responses.

RESULTS

The primary objective of the survey was to determine the perceptions of business and industry on the following:

1) Specific basic skills considered important for successful employment.
2) Actual competence in basic skills of entry level personnel with a secondary education.

Discrepancies between (1) and (2) were also important. One set of items on the questionnaire represented the degree of importance for success on the skill areas of mathematics, writing, reading, speaking/listening, reasoning, and science. A second set represented the perceived competence of entry level employees for the same basic skill areas.

A mean degree of importance and of competence was calculated for each skill area. These means were calculated as the sum of the individual item responses divided by the total number of items for that particular skill area. These means are given in Table 1. The skill areas for "importance for success" are listed in descending order. Speaking/listening and writing skills were considered the most important for success. Next came reasoning and reading skills. Only moderately important for success were the mathematical and scientific skills. Means for "competency" are also given in Table 1, as are the t-values for the discrepancies. Note that all the t-values are significant at the .0001 level. Competence was always below the level of skills needed for job success.

Table 1 about here

An analysis of individual item responses provided more specific information about importance, competence, and discrepancy. A complete listing of the items with their response means and discrepancy values are in Table 2. The most highly rated skill was the listening skill of following instructions or directions in

---

Table 2 about here

---

the performance of a specific task ($\bar{x}$ = 4.61). The results from speaking/listening ($\bar{x}$ = 4.08) and writing ($\bar{x}$ = 4.06) showed that most of these abilities were considered highly important. Answering and asking questions concisely and coherently, and speaking with others in a relaxed and self-confident manner were also rated highly. The most notable deficiencies were reported in the area of writing skills. Writing standard English sentences with correct punctuation, spelling, grammar, word usage, and structure were cited as the most deficient of all competencies (Mean difference = 1.55). The improvement of one's own writing by correcting errors and rewriting showed the next highest degree of deficiency (1.45).

The results which indicated that reasoning skills were regarded as important requirements for successful employment also showed wide discrepancies between these requirements and perceptions of actual competencies. Most noteworthy was the ability to identify problems, and subsequently, to propose and evaluate ways to solve them. Other skills included distinguishing between fact and opinion, and drawing reasonable conclusions for sources of information.

Additional valuable information was extracted from open-responses concerning other important skills for successful employment. The following is a listing of those most frequently cited skills or characteristics of a successful employee:

1. Good attitude toward work.
2. Willingness to adapt and to learn.
3. Getting along with others.

4. A neat and appropriate appearance.
5. Promptness and little absence from work.
6. Familiarity with basic computer knowledge, and the ability to interact with a computer.
7. Good communication skills, including oral, written, and listening.

DISCUSSION

Illinois, the second largest state in number of Fortune 500 companies, is experiencing a skills deficiency in its secondary school graduates. Business and industry need entry level employees who are competent in basic skills. These basic skills form the necessary foundation for more highly complex intellectual skills required in an increasingly sophisticated and versatile work environment. Employment capability, flexibility, and satisfaction are dependent on a high degree of ability in these basics. Deficiencies in the basics is no longer novel; it is a trend pervasive across the nation.

The results of this study demonstrate a significant discrepancy between what skills business and industry need and the actual level of competence secondary school graduates bring to the work place. This finding permeates the skill areas of writing, speaking/listing, reasoning, reading, math, and science. These results are similar to those reported in the CPR survey (1982).

Speaking/listening was rated the most important of all skill areas, and within it "following verbal instructions or directions" was rated the highest. This response paralleled CPR's 1982 report that business executives nearly always noted speaking and listening skills as an important requirement, and "this was true for all job categories in all industries," (p.14). Mundale (1982) noted that the Sperry Corporation regarded listening as the most important of the basic skills and they developed a campaign promoting good listening skills. Schools should note the importance placed on speaking/listening skills by business and industry.

An information-intensive society requires writing skills more than ever before. In spite of this need, personnel directors identifed "writing standard English sentences" as the most deficient competency. The ability to spell and punctuate properly, the use of appropriate grammar, and correct sentence structure are prerequisites to word processing skills and to other computer interactive skills. Employee deficiencies in writing memos, letters, and business reports in not uncommon. Companies have had to develop their own programs for enhancing succinct and coherent writing skills. Honeywell, for example, teaches courses in Business English and in Effective Memo and Report Writing (Mundale, 1982).

The changing nature of work will impact dramatically on the prominence of reasoning skills. Survey results clearly note the importance of these skills to business and industry. Future workers will have less rigidly defined job descriptions as automation, robots, and computers perform repetitive functions. The adaptable worker will be essential. Identifying problems, generating alternative solutions, and distinguishing between fact and opinion, formulating reasonable conclusions, and making decisions will all be trademarks of future workers.

The survey also indicated deficits in reading skills. The ability to comprehend the main ideas in written materials showed the largest reading deficit. The significance of reading in an information based society is clear. High school graduates with reading deficiencies will progressively face more and more employment problems, ranging from not getting a first job to not being able to hold one.

The skill area showing the smallest discrepancy between "skill importance" and "competence" was science. This is somewhat surprising in light of the present emphasis on advanced technology. Possibly the science skills may not yet be considered important across a wide range of job categories. Further inquiry is necessary to determine how important these skills will be for individuals in the future.

Mathematics was another area of deficiency for the survey. The results agreed with the CPR (1982) findings that there were high deficits in computation for whole numbers, decimals and fractions. The schools must do a better job of teaching these skills if graduates are to be employable.

Business and industry needs increased competence in communication and problem solving skills from high school graduates. Present educational practices are not adequately preparing students in these areas. The emphasis on accumulating knowledge as opposed to processing, interacting, and problem solving is a factor in students not transfering skills outside the classroom. Goodlad (1983) stated that students "rarely planned or initiated anything, read or wrote anything of some length, or created their own products; they scarcely ever speculated on meanings, discussed alternative interpretations, or engaged in projects calling for collaborative effort," (p.468). Teaching is more than telling, and learning is more than acquiring and demonstrating mastery of facts. In order to insure transferability of basic skills into the workplace, teachers must engage students as active participants in the learning process. Prospective employees will expect them to be active participants in the workplace.

IMPLICATIONS

Several implications for counselors and others who share the responsibility for facilitating youths' career planning can be drawn from this study. First, counselors can increase students' opportunities to experience success in their initial entry level position by encouraging them to have a command of the basic skills, particularly those skills involved in "following verbal instructions or directions" and "writing standard English sentences." This emphasis on basic skills would require a reexamination of both the utility and importance of those programs that teach job seeking skills, occupational survival skills, and pre-employment skills. It is not that these traditional career related programs are unimportant, clearly they are, but they cannot be emphasized to the exclusion of basic skill competencies.

Second, the study provides some evidence about the transition from school to work. The lack of knowledge about that transition represents one of the major shortcomings of career counseling (Rehberg & Hotchkiss, 1979). Based on this study, mastering the basic skills would appear to facilitate students' transition from school to work. Counselors may wish to use this information in two ways: by telling students of the importance of basic skills for entry level positions; and by completing similar studies in their own locale and using the results to explicate the nature of the school-to-work transition.

Finally, the procedures used in this study represent an alternative to traditional follow-up studies, which seek to determine what happened to students for 1 to 5 years after graduation. While the question of what happened to graduates is important, a more important question is how well did the graduates perform in their respective entry level positions. Answers to the second question reflect the efficacy of the educational program received by the students as perceived by the business community. Follow-up studies that address the question of efficacy are essential if the educational and business communities are to work together for the enhancement of individual adaptability as well as industrial growth.

References

Borg, W. R., & Meredith, D. G. (1983). Educational research (4th ed.). New York: Longman.

Center for Public Resources. (1982). *Basic skills in the U.S. workforce*. New York: Human Resources Executive Program.

Foster, S. G. (1982, December 15). Vocational education too narrow, experts say. *Education Week*, p.6.

Goodlad, J. I. (1983). A study of schooling: Some findings and hypotheses. *Phi Delta Kappan*, 64(7), 465-470.

Hemmings, M. B. (1982). *American education: An economic issue*. Washington, D.C.: U.S. Chamber of Commerce.

Mundale, S. (1980, October). Why more CEO's are mandating listening and writing training. *Training and Human Resources Development*, pp. 37-41.

Rehberg, R. & Hotchkiss, L. (1979). Career counseling in contemporary U.S. high schools. In D. Berliner (Ed.), *Review of Research in Education* (Vol. 7). Washington, D.C.: American Educational Research Association.

Table 1

Means and Standard Deviations for Skill Importance, For Competency, and t-values for Discrepancies

Skill	Importance mean	Std. dev.	Competence mean	Std. dev.	Discrepancy mean	t* values
Speaking & Listening	4.08	0.70	2.91	0.66	1.15	9.93
Writing	4.06	0.79	2.69	0.96	1.38	9.87
Reasoning	3.78	0.83	2.57	0.61	1.20	8.81
Reading	3.62	0.79	2.73	0.79	0.88	6.98
Mathematical	3.05	0.61	2.41	0.54	0.63	8.32
Scientific	2.59	1.06	2.07	0.73	0.52	4.83

*: all significant at .0001

Table 2

Skill Category Means, Item Means, and Discrepancy Values

Category and item	Importance $\overline{X}$	Competence $\overline{X}$	Difference between means
Speaking and listening skills	4.08	2.91	1.17
1. Engage critically and constructively in the exchange of ideas.	4.06	2.76	1.30
2. Answer and ask questions concisely and coherently.	4.27	3.06	1.21
3. Conceive and develop ideas about a topic for the purpose of speaking to a group; to choose and organize related ideas; to present them clearly in standard English.	3.16	2.24	.92
4. Follow instructions or directions in the performance of a specific task.	4.61	3.43	1.18
5. Speak with others in a relaxed and self-confident manner.	4.22	3.10	1.12
Writing skills	4.06	2.69	1.37
1. Select, organize, and relate ideas and to outline and develop them in coherent paragraphs.	4.02	2.65	1.37
2. Write standard English sentences with correct punctuation, capitalization, plural forms, possessives, and spelling.	4.45	2.90	1.55

(table continues)

Category and item	Importance $\overline{X}$	Competence $\overline{X}$	Difference between means
3. Write standard English sentences with correct verb forms, sentence structure, and word choice.	4.35	2.86	1.49
4. Improve one's own writing by correcting errors, restructuring, and rewriting.	4.10	2.65	1.45
5. Gather information from primary and secondary sources; to write a report using this research; to quote, paraphrase, and summarize accurately; and to cite sources properly.	3.39	2.34	1.05
Reasoning skills	3.78	2.58	1.20
1. Identify and formulate problems, as well as the ability to propose and evaluate ways to solve them.	4.00	2.66	1.34
2. Recognize and use inductive and deductive reasoning, and to recognize fallacies in reasoning.	3.65	2.44	1.21
3. Comprehend, develop and use concepts and generalizations.	3.57	2.48	1.09
4. Distinguish between fact and opinion.	3.90	2.68	1.22
5. Draw reasonable conclusions from sources of information and defend them rationally.	3.80	2.62	1.18

(table continues)

Category and item	Importance X	Competence X	Difference between means
Reading skills	3.62	2.73	.89
1. Identify and comprehend the main and subordinate ideas in a written work.	3.90	2.84	1.06
2. Vary one's reading speed and method according to the type of material and one's purpose for reading.	3.45	2.56	.89
3. Use the features of printed materials, such as table of contents, preface, introduction, titles, index, glossary, appendix, and bibliography.	3.41	2.78	.63
4. Define unfamiliar words by decoding, using clues, or by using a dictionary.	3.70	2.74	.96
Mathematical skills	3.05	2.41	.64
1. Perform the computations of addition, subtraction, multiplication, and division using whole numbers, fractions, and decimals.	4.29	3.14	1.15
2. Use effectively the mathematics of: ratios, percentages, averages, roots and powers.	3.04	2.23	.81
3. Use effectively the mathematics of algebra and geometry.	2.29	1.86	.43

(table continues)

Category and item	Importance $\bar{X}$	Competence $\bar{X}$	Difference between means
4. Make and use measurements in standard (English) units.	3.43	2.94	.49
5. Make and use measurements in metric units.	2.31	1.80	.51
6. Use elementary concepts of probability and statistics.	2.21	1.71	.50
7. Solve word problems involving time, weight, distance, and volume.	2.78	2.12	.66
8. Use a calculator to perform basic arithmetic operations to solve problems.	4.06	3.31	.75
Scientific skills	2.59	2.07	.52
1. Apply basic scientific/technical solutions to the appropriate problems.	3.14	2.35	.79
2. Understand the basic principles of mechanics and biology.	2.38	2.02	.36
3. Understand the basic principles of chemistry and physics.	2.26	1.85	.41